KEY Publishing

6 CUTAWAYS featuring 12 PROFILES

AVIATION ARCHIVE

BRITISH AIRCRAFT

OF WORLD WAR ONE

RFC | RNAS | RAF

AVIATION ARCHIVE
ISSUE 84
£9.99
ISSN 2632-6760
9 772632 676007 84

KEY Publishing

THE DESTINATION FOR AVIATION ENTHUSIASTS

Visit us today and discover all our latest releases

UPDATED THIRD EDITION
A celebration of the best-known fighter of World War Two
SPITFIRE at 90
1936 – 2026
FROM THE MAKERS OF FlyPast
1936-1926 90TH ANNIVERSAY
Supermarine Spitfire 90 RACING PEDIGREE
Supermarine Spitfire 90 MARITIME SERVICE
WINNI STR
DANIEL FORD SHOWS HOW THE SUPERMARINE RAC THE TECH
HOOKED AND FOLDED
A PORTFOLIO OF SEAFIRES – THE NAVAL VERSION OF THE SPITFIRE
DETA

In this 90th anniversary year, the publishers of FlyPast magazine present a special 100-page tribute to Britain's greatest fighter and possibly the best known combat aircraft in the world.

Using extensive archive images, the best of aviation writers and researchers salute the Spitfire's incredible heritage.

This edition has been updated with fresh imagery of present-day Spitfires in their element from renowned air-to-air photographer John Dibbs.

It presents a stunning portfolio from the day fighter Mk.I to the high-flying Mk.XIX and the wing-folding Seafires.

All of this adds up to a superb souvenir of a world famous fighter.

Order from our online shop today...

shop.keypublishing.com/spitfire-at-90

Call +44 (0)1780 480404 *(Monday to Friday 9am - 5.30pm GMT)*

**Free 2nd class P&P on BFPO orders. Overseas charges apply.*

026/26AA

Women workers make adjustments to a Sopwith Came, probably at an Air Depot in England, 1918.

NASM

British Aircraft of World War One

4 EDITORIAL
5 THE FIRST AIR WAR
9 BLERIOT MONOPLANES
10 ROYAL AIRCRAFT FACTORY BE.2
12 FARMAN AIRCRAFT
13 MORANE-SAULNIER
14 AVRO 504
18 SOPWITH TABLOID
19 BRISTOL SCOUT
20 CAUDRON G.3 AND G.4
21 VICKERS PUSHERS
25 ROYAL AIRCRAFT FACTORY F.E.2
26 PROFILES
28 SHORT 184
29 AIRCO D.H.2
31 SOPWITH FLOATPLANES
32 ROYAL AIRCRAFT FACTORY B.E.12
34 HANDLEY PAGE O/100 AND O/400
37 SOPWITH 1 1/2 STRUTTER
38 PROFILES
40 HIS MAJESTY'S AIRSHIPS
44 NIEUPORT BIPLANES
46 SOPWITH PUP
48 ARMSTRONG-WHITWORTH F.K.8
49 SPAD VII AND XIII
51 SOPWITH TRIPLANE
52 PROFILES
54 ROYAL AIRCRAFT FACTORY R.E.8
56 BRISTOL M.1
57 AIRCO D.H.4 AND 4A
60 AIRCO D.H.5
61 BIG PICTURE
62 BRISTOL F.2 FIGHTER
66 ROYAL AIRCRAFT FACTORY S.E.5
72 SOPWITH CAMEL
76 FELIXSTOWE FLYING BOATS
78 SOPWITH DOLPHIN
79 AIRCO D.H.4 AND 4A
83 VICKERS VIMY
87 SOPWITH SNIPE
90 AIRCO D.H.10
91 SOPWITH SALAMANDER
93 MARTINSYDE BUZZARD
92 HANDLEY PAGE V/1500
96 SURVIVORS
97 NEXT ISSUE

The Shuttleworth Collection's SE.5a is a genuine World War One veteran that flew with No. 84 Squadron in 1918.

Chocks Away!

World War One is a fascinating era in the development of warfare and particularly aviation. In 1914 the Royal Flying Corps and Royal Naval Air Service had barely any aircraft suitable for military tasks, but by the end of 1918 were flying heavy bombers on raids against the heart of Germany.

A complication with illustrating this subject is there are very few contemporary photographs of aircraft of the period in flight, and even fewer good ones. Although many aircraft carried cameras for reconnaissance, their precious film plates seem to have rarely been exposed on their formation partners, although flying boats and large bombers provide an exception as far as air-to-air photography is concerned. There were of course some widely published dramatic dogfight photos that were long ago exposed as fakes. As a result, there are few action shots available for the modern editor but these pages have been brightened a little with sparing use of photos of modern restored or reproduction aircraft and a couple of rare contemporary colour images.

For this issue David Willis has written the entries for the Sopwith Camel, S.E.5 and Nieuports and again has helped greatly with picture research and supply of images. Thanks also to David Evans for more photographs and Gavin Conroy for his wonderful air-to-air images. The profile illustrations are from the Key Archive, as are the uncredited images and others are only individually credited if sourced from elsewhere. Design is by Paul Sander/ Panda Media.

Jim Winchester

Aviation Archive Series

Attack Helicopters

- **Editor:** Jim Winchester • **Design:** Panda Media
- **Group CEO:** Adrian Cox
- **Distribution:** Seymour Distribution Ltd +44 (0)20 7429 4000 • **Printing:** Buxton Press Limited, Buxton, UK.

All rights reserved. The entire content of Aviation Archive is © Key Publishing 2026. Reproduction in whole or in part and in any form whatsoever is strictly prohibited without the prior permission of the Publisher. We are unable to guarantee the bona fides of any of our advertisers. Readers are strongly recommended to take their own precautions before parting with any information or item of value, including, but not limited to, money, manuscripts, photographs or personal information in response to any advertisements within this publication. Published by Key Publishing Ltd, PO Box 100, Stamford, Lincs PE19 1XQ. Tel: +44 (0) 1780 755131. Fax: +44 (0) 1780 757261. Website: www.keypublishing.com

A Fokker Triplane dives on a Bristol Fighter, but exposes itself to the British observer's gunfire. Today World War One is beyond living memory, but a feel of the air war can be had at air shows where replica aircraft stage mock dogfights for modern audiences.

Jim Winchester

Introduction

The First Air War

In a few short years military flying evolved from an amateurish pastime for young officers to a form of power that could compete with armies and navies. In Britain the air services drove innovation in aeronautics, weapons, communications, photography and many other fields.

When the Royal Flying Corps went off to war in August 1914, its total complement was 147 officers and 1,097 men, with a total of 179 aeroplanes. Of these, just 48 serviceable machines could be mustered to fly to France. By the Armistice, four years three months and 14 days later, the new Royal Air Force had grown to 27,333 officers and 263,837 other ranks, with 3,300 aircraft on first-line strength and 103 airships. In 1914-18 the RFC, RNAS and RAF suffered 9,378 killed or missing, with 7,245 more wounded.

One of the first RFC reconnaissance missions of the war, on 23 August 1914, spotted the German II Corps about to flank the British rear near Mons. The pilot's report gave enough warning for an orderly retreat to better positions.

Aerial reconnaissance was at first purely visual, with its worth depending on the crew returning in a timely fashion with a comprehensible report. Although at first, opposing airmen did little more than wave at each other, soon they took to carrying weapons to disrupt each other's vital missions.

Before armament standardised on two types of rifle-calibre machine-gun, the belt-fed Vickers and the Lewis with its distinctive ammunition drums, RFC and RNAS pilots improvised. Some took to carrying Webley-Fosbery automatic revolvers and then Holland and Holland 12-bore shotguns. Others mounted pairs of rifles along the fuselage sides and there are accounts of steel darts, grenades on strings and even grappling hooks being employed in attempts to bring down enemies.

Light machine-guns were fitted to two-seaters in a variety of awkward mounts, but for single-seaters aircraft with the more efficient tractor propeller the problem was that any rapid-firing weapon placed where the pilot could charge and reload it would fire through the arc of the propeller, inevitably damaging it.

Capt. Lanoe Hawker and Airman E.J. Elton of No. 6 Squadron conducted experiments with a Lewis gun mounted on the fuselage, pointed at 45 degrees from the line of flight to clear the propeller. On 25 July 1916 Hawker drove down three German two-seaters, and was awarded the Victoria Cross, the first fighter pilot so honoured. Hawker also flew the two-seat F.E.2, and using the two aircraft scored seven victories before returning to England in September, becoming the first British fighter ace.

Frenchman Roland Garros tested the Morane-Sauliner Type L with deflector plates on the propeller blades and a forward-firing Hotchkiss machine-gun with solid copper bullets. This became the first aircraft able to shoot through the propeller arc. Garros himself scored three

Visual and photographic reconnaissance was a vital RFC role in World War One. Here a warmly dressed observer hands exposed photographic plates to an airman.

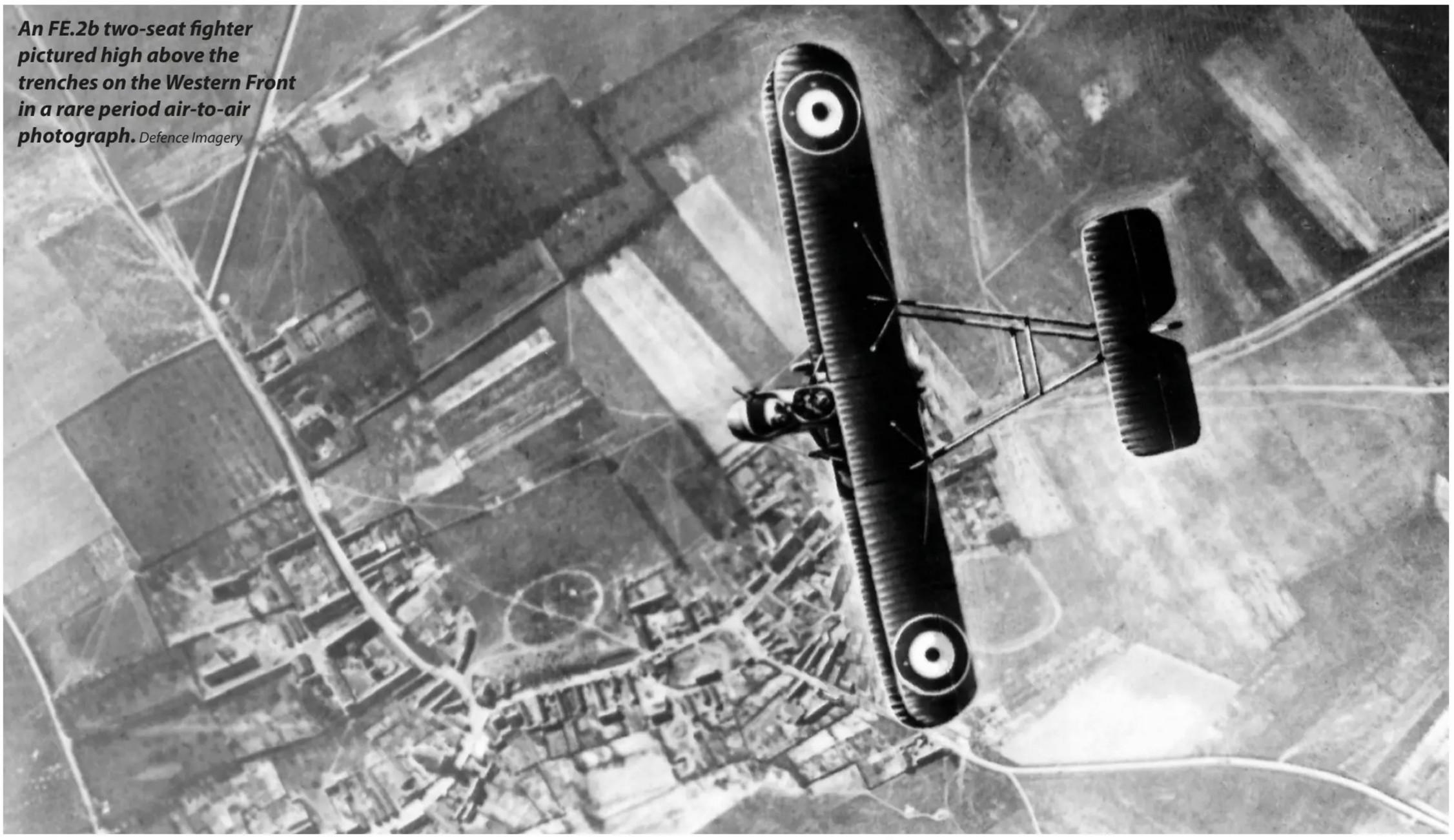
victories before being forced down with engine trouble. Studying his aircraft led Anthony Fokker to develop an interruptor gear that prevented the gun from firing when a propeller blade was passing the gun barrels. Applied to the Fokker E.1 and subsequent monoplanes, this turned the tide in favour of the German Air Service in one of several reversals of air superiority during the war.

The Allies produced a number of different interruptors, the most successful designed by George Constantinescu, which was fitted to Sopwith fighters.

The standard 0.303in ball ammunition proved mostly useless against airships as they failed to ignite the hydrogen-filled gas cells that provided lift. Rankin incendiary darts were not much more successful, but the development of Brock, Pomeroy and Buckingham incendiary bullets allowed fighters to down several Zeppelins during the course of the war although it could take multiple drums of ammunition to set one afire.

Training new pilots to meet the growing demands of the forces began in a haphazard fashion. There were no dual-control aircraft

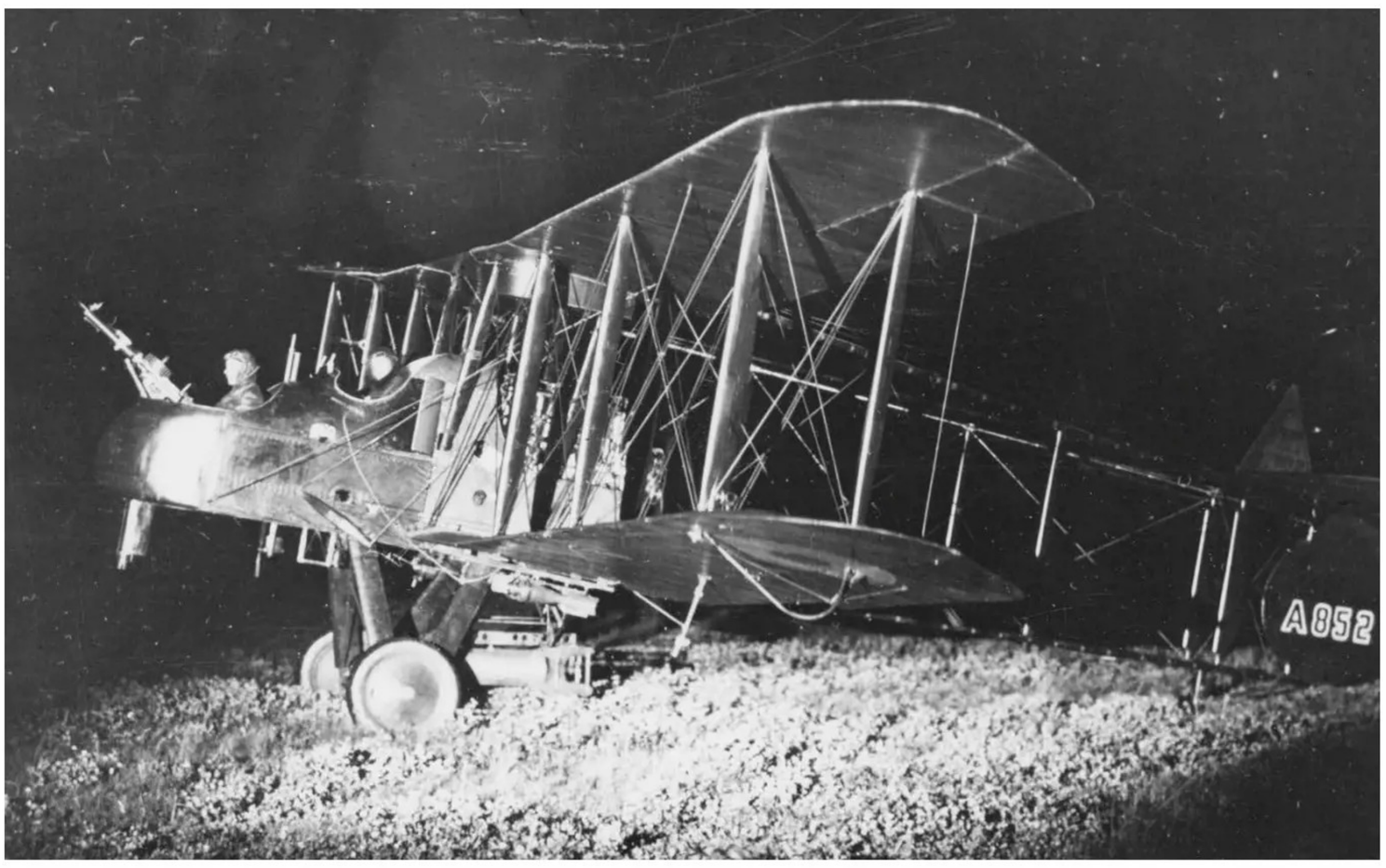
The Westland factory at Yeovil mostly sub-contracted to other manufacturers during the war, building D.H.4s, Strutters and Vimys. Here, women workers assemble wing ribs. *Leonardo*



An FE.2b two-seat fighter pictured high above the trenches on the Western Front in a rare period air-to-air photograph. *Defence Imagery*

at first. The pupil sat behind the pilot and reached over his shoulder to manipulate the joystick; he had no access to rudder or engine controls. After a few hours of this sort of instruction, they would swap places. Things changed for the better when Major Robert Smith-Barry of the School of Special Flying at Gosport, Hampshire chose the dual-control Avro 504 as the most suitable training machine and introduced a form of teaching where the pupil would be guided through manoeuvres through a constant 'patter' from the instructor, delivered through a speaking tube. This 'Gosport Method' would become standard for military aviation training worldwide.

Airmen supplemented their officially issued flying clothing with private purchases, mainly in an effort to keep themselves warm and alert. To keep out the bitter cold at altitude, some ever resorted to stuffing their clothes with newspaper. Various types of helmet and leather hood provided limited head protection, but offered some warmth and noise attenuation. Goggles, sometimes splinter proof, kept out the wind and the castor oil which rotary engines threw off constantly while operating. The silk scarves long associated with the first combat aviators were not just an affectation, they allowed the head to turn without the neck rubbing on a stiff uniform collar.



Armed with 20lb bombs underwing and an RL bomb under the fuselage, an F.E.2 of No. 100 Squadron prepares to set off on a night raid.

Reconnaissance and artillery spotting remained the main task of aeroplanes for most of the war. As early as September 1914, wireless Morse code transmitters were being carried by RFC aircraft. These devices weighed at least 75lb (34kg), however, and further reduced the marginal performance of the carrying aircraft, as did the 250ft (76m) of trailing wire antenna that had to be spooled out and back in again. As aircraft and techniques improved, wireless telegraphy became standard, By early 1916 this was being supplemented by two-way voice transmitter/receivers. One of the unsung roles in the RFC and early RAF was the wireless operator, who was attached to the artillery units in the field and relayed signals from aircraft to the gunners. Setting up and repairing a 30ft (aerial, often under return shellfire, the operator's job was a hazardous one and on average more than 400 became casualties in each year of the war.

There were few aerial bombs in 1914, although the Royal Naval Air Service (RNAS) had

The war wasn't just fought on the Western Front. This Frank Hurley colour image depicts Bristol Fighters of 1 Squadron Australian Flying Corps in Palestine, 1917. *State Library of New South Wales*

done some pioneering work in developing anti-submarine weapons. A search of the stocks at the outbreak of war found just 26 20lb Cooper bombs in storage at Eastleigh. This weapon contained just 4lb (1.8kg) of high explosives in a steel case and the later Hales Bomb 4.5lb (2kg) in a lighter case. Only 700 more bombs were produced by the end of 1914. Early raids used artillery shells against structures, hand grenades and steel darts (flechettes) against troops, and three-pronged spikes that were designed to burst vehicle tyres and nobble horses.

Before long, bigger weapons were in service, notably the 112lb, 520lb and 550lb RL (Royal Laboratory) bombs and the more aerodynamic 230lb RFC weapons. The grimly named Baby Incendiary Bomb was designed to start fires in urban areas and was dispensed from a container holding up to 272 such weapons. The largest British bomb of the war was the 1,650lb SN bomb, which could only be carried by the heavy bombers that appeared in 1918.

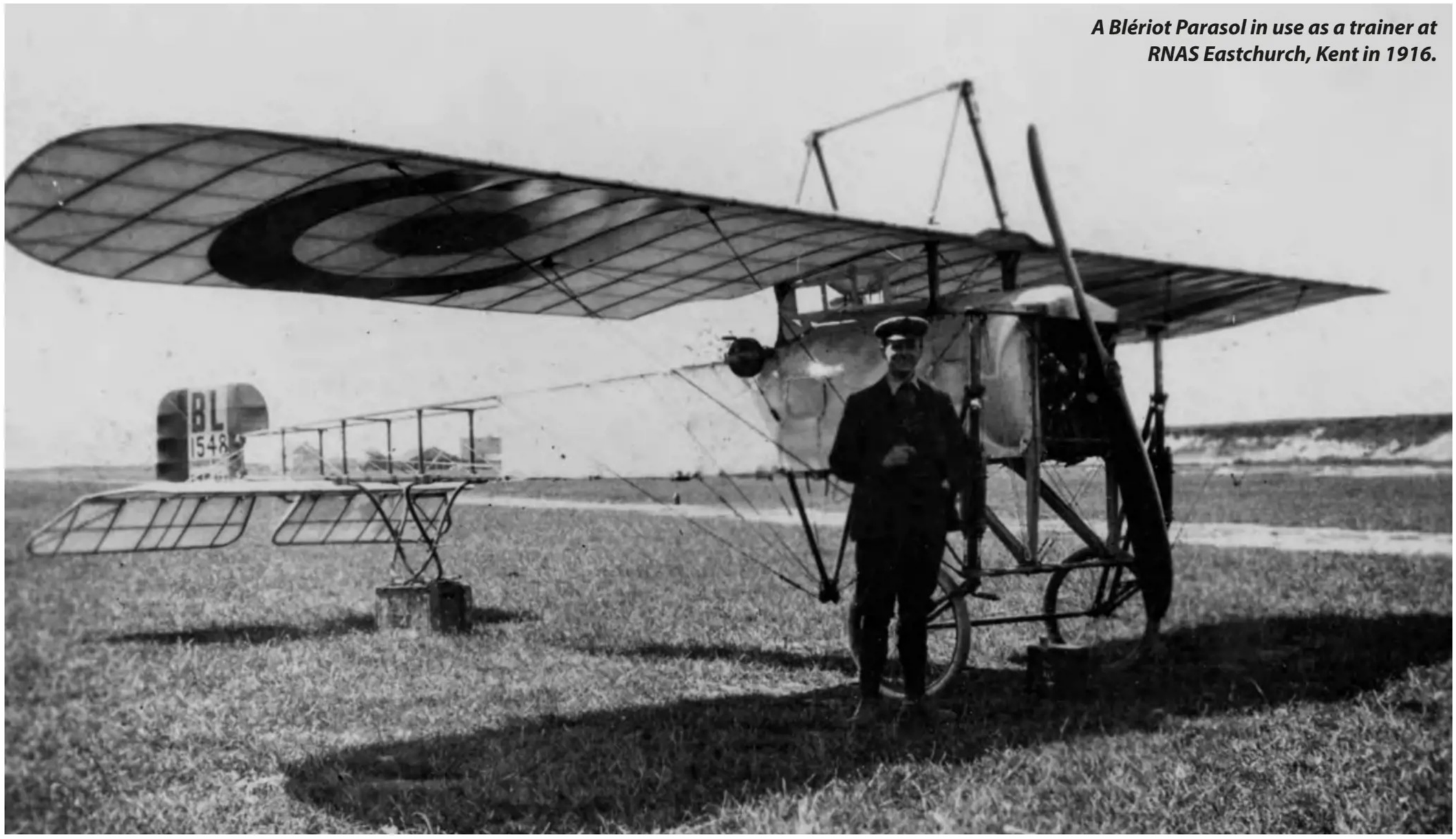
By mid-1916, bomb production had reached 1,900 per week and 5,900 by October 1917. At the time of the Armistice, factories were gearing up to deliver 26,500 weekly.

On April Fool's Day 1918, the RFC and RNAS were merged to become the Royal Air Force with 'Boom' Trenchard appointed its first Chief of Staff. Two months later, the Independent Force was established to take the war to the heart of Germany. Like its successor, Bomber Command, its effectiveness in shortening the conflict is debatable, but had the war continued into 1919, Berlin would have suffered much more than London did during the Zeppelin and Gotha raids of 1915-18.

More than 80 firms in the UK built aeroplanes for the 1914-18 war effort, and many others produced components for them. By war's end British aircraft manufacturers were producing 3,500 aircraft a month. There was much cross-Channel cooperation, with French firms and their British subsidiaries supplying many aircraft including Spads and Nieuports to the RFC and RNAS, and Britain equipping the French Air Service with Sopwith 1 ½ Strutters

Several of the great British aviation companies got their start in the war years. A.V. Roe produced just one significant type, the Avro 504, before 1918 but became a preeminent designer of bombers, as did Handley Page. Airco took the name of its chief designer and became de Havilland, which again had a long and illustrious history. Bristol earned cash rebuilding its own Fighters for the RAF and with various civil designs, before creating some of the most important light bombers of World War Two. Sopwith found itself with huge tax bills for their war profits and closed down, but re-emerged under the surname of their chief test pilot, Harry Hawker. They continued making combat aircraft under that name into the 1970s before, like most of the other great firms, they merged into British Aerospace.

Other companies got out of aviation altogether. The Royal Aircraft Factory gave up manufacturing in favour of research and became the Royal Aeronautical Establishment. Martinsyde suffered a factory fire and went out of business altogether. British Caudron turned to furniture-making. Others returned to their pre-war activities of electrical engineering or coachwork. In a different form, the dispersal of aircraft and component manufacturing to other industries and small firms would return in the late 1930s with the 'shadow factory' scheme, which would allow a quick increase in aircraft production when war broke out again in 1939. ■



A Blériot Parasol in use as a trainer at RNAS Eastchurch, Kent in 1916.

Blériot Monoplanes

First in Action

The low-performance Blériot monoplanes were barely effective as either combat aircraft or trainers, but when called upon did their duty until more suitable aircraft became available.

The Blériot Type VIII of 1908 was the first aircraft with a central joystick and used wing-warping for roll control. Louis Blériot, working with Raymond Saulnier, developed the Blériot VIII, into the Type XI, which established the basic configuration for single-engined monoplanes.

The Blériot XI flew on 23 January 1909 with a 35hp (26kW) seven-cylinder semi-radial R.E.P. engine turning a four-bladed paddle propeller. The aircraft flew well but the engine was unreliable and was replaced by a 25hp (Anzani three-cylinder semi-radial, or 'Y'-configuration engine and a scimitar propeller. The design was refined and made several record flights before its most famous on 25 July 1909 when Louis Blériot himself crossed the English Channel between Calais and Dover. Soon Blériot-Aéronautique had many orders for XIs from governments and wealthy individuals.

The Duke of Westminster presented a Blériot to the War Office in 1910, two years before the formation of the Royal Flying Corps. Two more Type XIs participated in trials on Salisbury Plain in 1912 and at least nine were acquired by the RFC before the war. On its outbreak, as many more as could be gathered were impressed from their civilian owners, including XI-2 two-seaters.

Blériots were mostly issued to No. 3 Squadron, which flew to France ion 13 August 1914.

One XI-2 crashed en route and the occupants became the first wartime casualties of the RFC.

Only six days later the first operational mission of the RFC was carried out by Lt (later Air Chief Marshal) Phillip Joubert de la Ferté in a Blériot XI-2, flown solo on a reconnaissance flight.

New aircraft were ordered from the maker in France and subsidiary Blériot Aeronautics at Hendon, with a total of 119 accepted by the RFC and around 25 by the RNAS. British aircraft were powered by 50, 70 or 80hp (37, 52 or 60kW) Gnome engines. The Type IX's performance was somewhat pedestrian, with a climb rate of 230ft (70m) per minute, but it was a stable reconnaissance platform.

Other squadrons to fly the Type XI were Nos 6, 9 and 16, but the lightweight Blériots deteriorated in field conditions and served in diminishing numbers until June 1915, but more were ordered as trainers after this time.

The Blériot Parasol was very similar but had the wing raised above the fuselage, giving a clear downward view for reconnaissance and artillery signalling duties. It was also used on occasion as a bomber, using hand grenades as well assorted makeshift bombs until retired from operational service in June 1915. ■

Blériot XI

Crew: One
Length: 27ft 6in (7.80m)
Wingspan: 34ft 3in (8.90m)
Height: 8ft 2in (2.5m)
Empty weight: (265kg)
Max T/O weight: (415kg)
Powerplant: One Gnome piston engine rated at 80hp (67kW)
Max speed: 66mph (106km/h)
Service ceiling: 3,280ft (1,000m)
Endurance: 3hr
Armament: None, or pistols and rifles

B.E.2c replica ZK-CBE at an air show in New Zealand. The original 2612 was paid for by the people of St. Catherines Ontario and flew with No. 16 Squadron from April to June 1916 when it was wrecked. *David Evans*

Royal Aircraft Factory BE.2

The "Quirk"

The B.E.2 was designed with emphasis on stability, which made it particularly suitable for reconnaissance. Unfortunately, it could not evade more manoeuvrable enemy types. Nonetheless, more than 3,200 were built by 20 contractors.

His Majesty's Balloon Factory at Farnborough became the Army Aircraft Factory in 1911 and soon after the Royal Aircraft Factory. Among its talented designers and engineers were Geoffrey de Havilland and Frederick Green, who together worked on an all-new design, notionally a rebuilt Voisin, which flew in December 1911.

This was the B.E.1, where B.E. stood for 'Blériot Experimental' although this is because it embodied certain features of Blériot designs, mainly its tractor configuration rather than having a direct connection with Louis Blériot or his company. Fitted first with a 60hp (45kW) Wolseley engine then a Renault of the same power, the B.E.1 was used by the RFC for artillery spotting and wireless trials before it crashed in January 1915.

The very similar B.E.2 was flying by February 1912 with the Renault engine and unequal span wings and in August earned the highest marks in the aircraft trials at Larkhill, although the Cody Biplane was declared the winner. During the competition, the two-seater broke the British altitude record, climbing to 10,560ft (3,218m).

Only a handful more B.E.2s were built at Farnborough, but large numbers were ordered from Bristol, Vickers, Coventry Ordnance Works, Handley Page and Armstrong Whitworth.

Fitted with equal span wings, the unarmed B.E.2a was introduced in 1913 and issued to Nos. 2 and 4 Squadrons.

The B.E.2a was the first British aircraft to arrive in France during the war on 13 August 1914.

With revised flying controls, a modified top decking and new fuel system, the B.E.2b was also ordered in large numbers. Flying a B.E.2b of No. 2 Squadron, 2nd Lt William Rhodes Moorhouse made a low-level bombing attack on Courtrai railway station on 26 April 1915. Badly wounded several times by ground fire, Rhodes-Moorhouse nursed his aircraft back to his home airfield and insisted on making his report before seeking medical attention. Rhodes-Moorhouse died the next day. He was awarded the Victoria Cross, becoming the first airman to receive Britain's highest award for valour.

The B.E.2 was regarded as general maid of all work, from photography to artillery spotting

BE2d 5834 was transferred from No. 10 Squadron to No. 16 Squadron in January 1917. On 6 April it was shot down in flames by a German fighter while on a photographic mission. The crew were killed

and even agent dropping. The wings were staggered and ailerons fitted on all surfaces on the B.E.2c, which was the main production version. Power came from a 90hp (67kW) R.A.F. 1a engine. The B.E.2ds had dual controls and 105hp (78kW) R.A.F. 1b engines, and the B.E.2e had unequal span wings and a revised tail design. Although climb performance and handling improved, the last model B.E.2 was only about 3mph (5km/h) faster than the first.

In mid-1915 the nature of air war changed with the arrival of the agile Fokker Eindecker with its forward-firing guns. Reconnaissance and bomber aircraft were shot from the skies, with the B.E.2s suffering the worst losses. Reconnaissance aircraft soon needed large escorts, but if a B.E.2 was caught by a fighter, usually all it had to defend itself was pistols or rifles fired by the observer. With the observer in the front, no effective machine-gun arrangement was possible, although a Lewis gun could be fitted on an awkward mount. Continued employment (and production) of B.E.2s in an increasingly dangerous environment led to claims in Parliament that young men were being sent out to be murdered. In April 1917 no fewer than 60 were lost. Soon most were offered more suitable employment as trainers, while others found some use, if not great success, as Home-based night fighters or for coastal patrol. ■

This B.E.2b of No. 4 Squadron force-landed near Lille and was captured by the Germans in March 1915. With its wings removed for road transport, it was taken for evaluation. *NARA*

RAF B.E.2c

Crew: Two
Length: 27ft 3in (8.30m)
Wingspan: 36ft 10in (11.23m)
Height: 11ft 4in (3.45m)
Empty weight: 1,370lb (621kg)
Max T/O weight: 2,142b (972kg)
Powerplant: One RAF 1a V-8 piston engine rated at 90hp (67kW)
Max speed: 72mph (116km/h)
Service ceiling: 10,000ft (3,050m)
Endurance: 3hr 15min
Armament: One 0.303in Lewis machine-gun

Shorthorn A371 lasted barely a month at a training school in England before being written off and broken up for parts in July 1916

Farman Aircraft

Longhorns and Shorthorns

Société Henri et Maurice Farman produced a large number of aircraft for France, but a variety of the brother's designs also served with the British forces in different roles throughout the war.

The first Farman aircraft purchased by the British War Office was the Type Militaire in November 1910, which was rebuilt after a crash as the F.1, the first British military aircraft with an official designation. In 1912 two Henry Farman Biplane pushers followed as did the 'Wake up, England' biplane, which was purchased from Claude Grahame-White in 1913 to make up a shortfall in claimed numbers of RFC aircraft.

Grahame-White also sold the War Office his Henry Farman F.20, and three more were acquired, at least one built at Hendon by Airco. One of these was used for some of the earliest trials of a machine-gun aboard an aircraft, although weapons did not become standard.

No. 5 Squadron took four F.20s to France in August 1914 and Lt Louis Strange fitted a Lewis gun to his and started pursuing German aircraft until ordered to remove it. He also dropped petrol bombs on enemy columns. Very soon, however, those Farmans that hadn't been wrecked were back in England as trainers.

A group of Henry Farman F.27s were acquired in France. These had a steel-frame structure and were more suitable for warm climates than wooden framed aircraft. Several were sent to South Africa and used to bomb targets in German South-West Africa (now Namibia). F.27s also saw service in Aden and India.

The Maurice Farman S.7 was a pusher with a box-framed fuselage. An elevator was mounted on long struts ahead of the crew nacelle and there were long skids to prevent nose-overs. This arrangement led to the name 'Longhorn'. There were 33 in service with four squadrons at the outbreak of war, but very few appeared in France. A small number served in Egypt and Mesopotamia, but most finished their careers at training schools.

With a monoplane tail and lacking the characteristic forward elevator and long skids of the Longhorn, the S.11 was inevitably known as the 'Shorthorn' and nicknamed the Mechanical Cow' or the 'Rumpety' (for their rough-running engines, at least on start-up). The first examples entered RFC service in March 1914. A handful were sent to France and joined by more purchased locally, partly equipping five squadrons. The last survivor was returned to England in November 1915. Others performed survey flights in Mesopotamia and other reconnaissance duties until about May 1916, while as trainers many served until the Armistice. ■

Maurice Farman S.11 Shorthorn

Crew: One or two
Length: 30ft 6in (9.30m)
Wingspan: 51ft 9in (15.78m)
Height: 10ft 4in (3.15m)
Empty weight: 1,442lb (654kg)
Max T/O weight: 2,046 lb (928 kg)
Powerplant: One Renault V8 piston engine rated at 80hp (60kW)
Max speed: 72mph (116km/h)
Service ceiling: Unknown
Endurance: 3hr 45 min
Armament: (Rarely) One 0.303in Lewis machine-gun; personal weapons

Morane LA was issued to No. 1 Squadron in late July 1916. It crashed on 8 September following engine failure on take-off. The two crew survived.

Morane-Saulnier Aircraft

Parasols, Bullets and Biplanes

The RFC acquired a motley collection of French Morane-Sauinier aircraft for reconnaissance and scouting. On the whole they were unpopular with pilots, but were regarded as sturdy, and many had long operational careers.

Société des Aéroplanes Morane-Saulnier built a number of successful monoplanes before the war, including the Type G two-seater and otherwise identical single-seat Type H. These were shoulder-wing designs not dissimilar to the Blériot XI. The Grahame-White Company at Hendon built some under licence for civilian use before the war and several were impressed for military service, mostly as trainers.

The parasol-winged Type L was the first aircraft to be fitted with a fixed, forward-firing gun. The Type LA was a refined version with 'A' signifying ailerons as opposed to wing-warping.

The RFC acquired up to 50 of them from different sources in France. They were issued to Nos. 1, 3 and 60 Squadrons as were most of the later Moranes.

A Type L scored one of the first victories credited to the RFC when the observer of a No. 3 Squadron aircraft drove down a German Aviatik with rifle fire on 5 February 1915.

The most notable use of the Morane in RFC service was when Sub-Lt Reginald 'Rex' Warneford attacked and destroyed Zeppelin LZ37 over Ghent on 7 June 1915, using six 20lb Hale bombs. His Type L (3253) was damaged by the explosion and he landed behind enemy lines, fixing the engine with the help of his cigarette holder before taking off and returning to base. For this action Warneford received the Victoria Cross, the first naval aviator to be so awarded.

Nicknamed 'Bullets' on account of their streamlined propeller spinners and generally sleek shapes, the shoulder-winged Morane Types N, I and V Scouts entered RFC service from September 1915. With wing warping for lateral control and over-sensitive rudders, they were tricky to fly and disliked by pilots. Eustace Grenfell was the only British Morane ace, claiming five of his seven victories while flying Type Ns with No. 1 Squadron.

Morane BBs were two-seat biplanes armed with two Lewis guns. The French military rejected it but the RFC bought more than 80, which gradually replaced the parasol types. At one point No. 60 Squadron was equipped with LAs, Ns and BBs.

The Type P was a two-seat reconnaissance parasol of which more than 140 were procured for the RFC, it lasted in frontline service as late as September 1917 and into 1918 as trainers. ■

Morane-Saulnier Type L

Crew: One or two
Length: 22ft 7in (6.88m)
Wingspan: 36ft 9in (11.2m)
Height: 12ft 11in (3.93m)
Empty weight: 847lb (385kg)
Max T/O weight: 1,441lb (655kg)
Powerplant: One Gnôme rotary piston engine rated at 80hp (
Max speed: 72mph (115km/h)
Service ceiling: 13,123ft (4,000m)
Endurance: 2hrs 30min
Armament: One

Some 504s were converted to single-seat night fighters to counter Zeppelin raids. Note the Lewis gun on a Foster mount above the wing.

Avro 504

Bomber, Fighter, Trainer

The most numerous British aircraft of the war, the Avro 504 began its career as a combat aircraft but went on to be the primary trainer for the RFC and RAF into the 1930s.

The Avro Type E or 500 biplane of 1912 was purchased in limited quantities by the War Office for the Military and Naval Air Wings. It was developed into the Avro 504 with increased wing stagger and a narrower fuselage and was was flying at Brooklands by July 1913.

Like many early aircraft it featured long skids beside the undercarriage wheels to prevent it nosing over when landing on soft ground. The elevators were unbalanced and yaw control came from a comma-type rudder, initially with no fixed fin.

Small numbers of 504s were ordered in the last months of peace and issued to various RFC and RNAS unis.

An Avro of No. 5 Squadron became the first RFC aircraft to be shot down, on 22 August 1914, when it was hit by rifle fire. The 504s were involved in some early aerial combats, using pistols and carbines fired by the observer. At least two German aircraft were claimed as "forced to land" before the end of 1914.

As a bomber the 504 could carry only four 20lb bombs, but these were used to effect on 21 November when four RNAS Avros attacked the Zeppelin base at Friedrichshafen in southern Germany, damaging airship sheds and destroying the hydrogen generating plant.

On 17 May 1915 Flt Cdr Arthur Bigsworth attacked Zeppelin *LZ-39* over Ostend with 20lb bombs. These damaged four of its five gas cells, but it limped back to its base. With more capable aircraft needed in France, some RFC and RNAS Avros were issued to Home Defence squadrons. These usually had a Lewis gun on a Foster mount above the wing.

There were 240 505Bs built by four contractors and 80 single-seat 504Cs for the RNAS, but most models up to the 504J were in small batches or experimental in nature.

By Mid-1915 the 504 was considered obsolete for a front line role, but its stability and docile handling made it an ideal training aircraft. At the School of Special Flying at Gosport, Hampshire, Major Robert Smith-Barry evaluated various types before choosing the Avro 504J as the most suitable for his method of dual instruction. Smith-Barry's techniques, including communication between pilot and instructor through a speaking pipe (which became known as the Gosport tube), were widely adopted, and so was the Avro 504. There were 1,050 504Js and large numbers were ordered as the 504K, with a universal mounting that could take a variety of engines. These ranged from the 90hp (67kW) R.A.F. 1A to the 220hp

Avro 504A B9452 served at RAF Montrose, Scotland in 1918 with No. 6 Training Squadron and No. 32 Air Depot Squadron. Many American airmen were trained at the airfield.

Avro 504J N5812. The J was the first version built in large numbers for training. *USMC Archives*

(164kW) Hispano-Suiza. At least 14 contractors built 504Ks in the UK, plus others in Australia, Belgium, Canada and Japan. Official wartime production was 3,696 by Avro and 4,644 by other manufacturers, including Sage, Henderson, Hewitt & Blonde, Grahame-White, Harland & Wolff, Sunbeam and Brush. Unlicensed examples produced in Russia as the U-1 equipped Soviet flying schools into the 1930s.

The design was modernised after the war, creating the 504N with a revised undercarriage without skids and an Armstrong-Siddeley Lynx radial engine. This was larger than the original Clerget rotary and had no cowling. Sometimes the 504N was called the Avro Lynx and the later 504R, the Gosport.

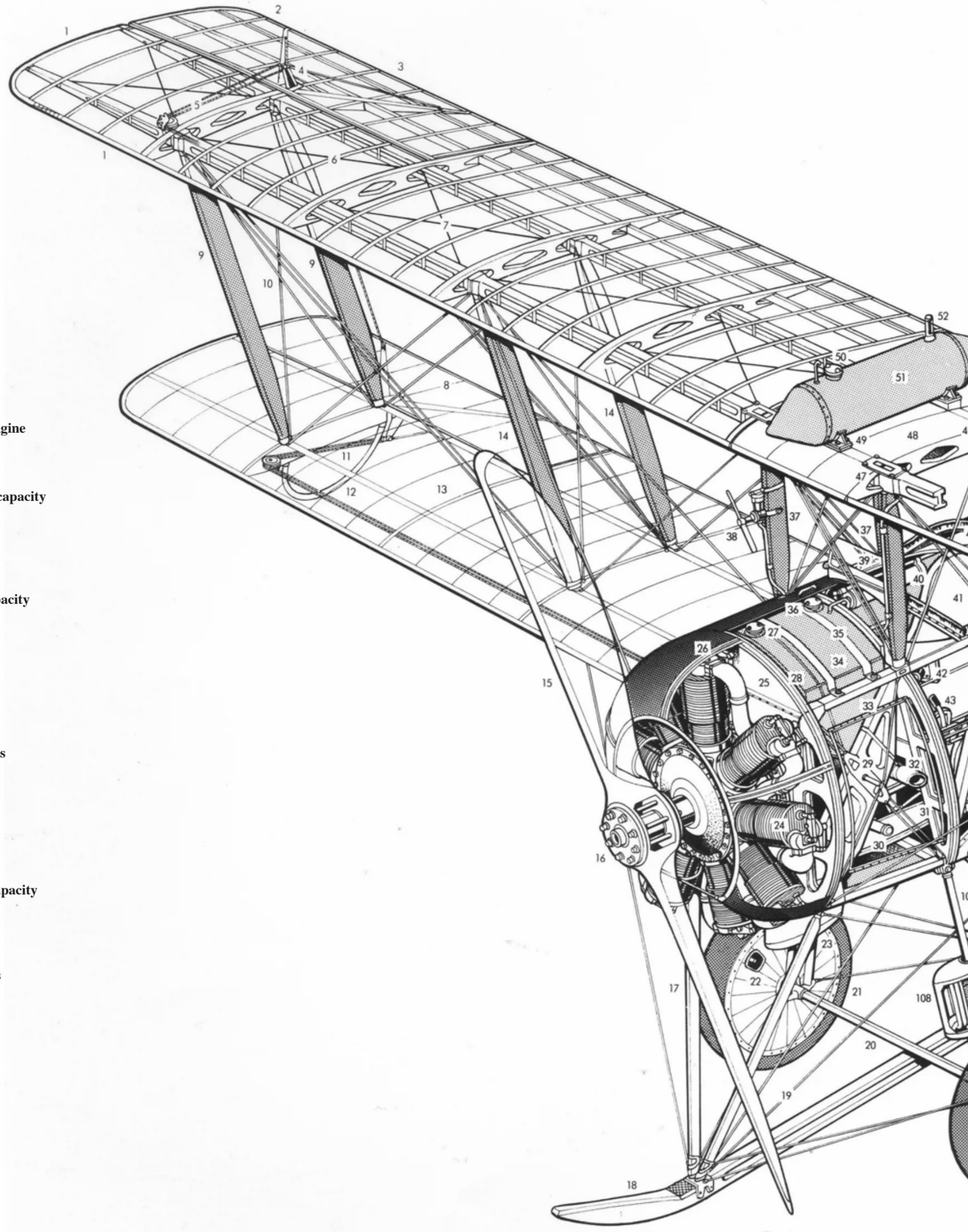
Avro 504s were sold to many countries after the war, training the pilots of many new air forces, including Australia, New Zealand and Norway. Greece received thirty 504Ns and twelve 504Ks, and some were still in service at the outbreak of World War Two.

SABCA in Belgium licence-built 28 504Ks from 1924, 15 504Ns in 1934, ten in 1937 and a final ten in 1939. This finally brought to end production that had begun before World War One. Some Belgian Avros escaped to French Morocco during the German invasion. ■

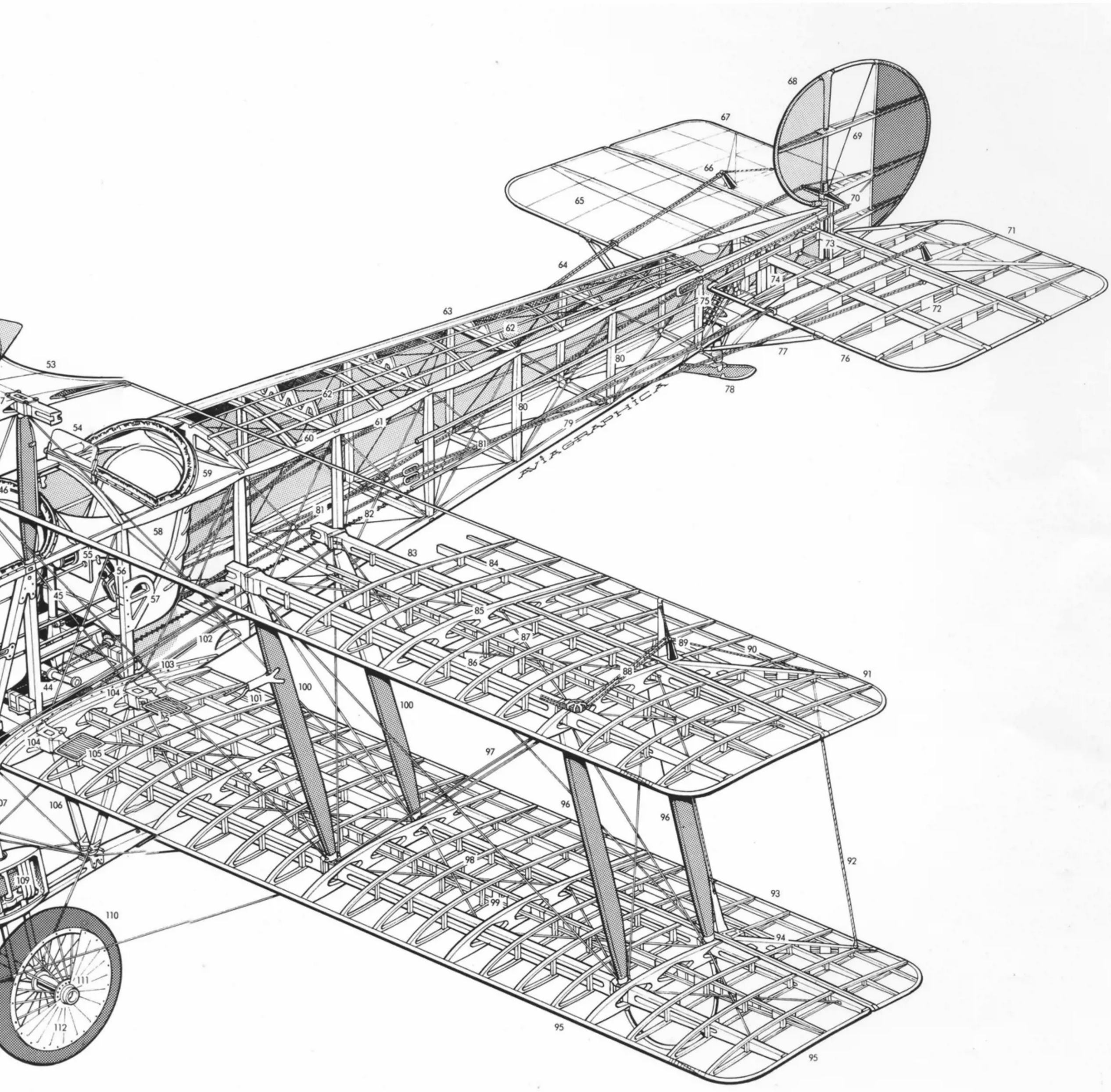
Avro 504K

Crew: Two
Length: 29ft 5in (8.97m)
Wingspan: 36ft 0in (10.97m)
Height: 10ft 5in (3.17m)
Empty weight: 1,230lb (558kg)
Max T/O weight: 1,829lb (830kg)
Powerplant: One Le Rhone radial piston engine rated at 110hp (82kW)
Max speed: 95mph (153km/h)
Service ceiling: 16,000ft (4,875m)
Endurance: 3hrs
Armament: None

Avro 504K



1 Wooden leading edge and wing tip
2 Tubular steel trailing edge
3 Starboard upper aileron
4 Aileron control horn
5 Aileron interconnecting cables
6 Starboard upper wing panel panel
7 Inter-spar diagonal wire bracing
8 Starboard lower aileron
9 Outboard interplane struts
10 Diagonal bracing wires
11 Ventral aileron operating cables
12 Starboard wing tip skid
13 Wing panel fabric covering
14 Centre interplane struts
15 Two-bladed wooden propeller
16 Propeller hub fixing bolts
17 Landing skid front struts
18 Wooden landing skids
19 Skid bracing wires
20 Axle beam
21 Starboard mainwheeel
22 Tyre inflation valve
23 Starboard shock absorber leg strut
24 110hp Le Rhône nine-cylinder rotary engine
25 Engine mounting bulkhead
26 Aluminium engine cowling
27 Oil filler cap
28 Engine oil tank. 6.5 Imp gal (29.5 litre) capacity
29 Diagonal engine bearer
30 Pilot's footboard
31 Sloping fuselage bulkhead
32 Carburettor air intake
33 Fuselage access panel
34 Main fuel tank, 20 Imp gal (91 litre) capacity
35 Fuel tank fixing straps
36 Fuel filler cap
37 Centre-section struts
38 Wind-driven fuel pressurisation pump
39 Windscreen panel
40 Fuel priming pump
41 Front pilot's seat
42 Ignition switch
43 Front throttle and mixture control levers
44 Rudder pedal bar
45 Control column
46 Cockpit coaming
47 Upper wing panel spar joints
48 Wing centre section
49 Fuel tank fixings
50 Fuel filler cap
51 Gravity fuel tank, 4 Imp gal (18 litre) capacity
52 Fuel contents sight glass
53 Trailing-edge cut-out
54 Rear cockpit windscreen
55 Instrument panel
56 Rear throttle and mixture control levers
57 Boarding step
58 Rear pilot's seat
59 Cockpit section plywood decking
60 Fuselage top longeron
61 Plywood stiffening side members
62 Dorsal frame and stringer construction
63 Fuselage fabric covering
64 Elevator control cables
65 Starboard tailplane
66 Elevator control horn
67 Starboard elevator
68 Tubular steel rudder edge member
69 Rudder construction
70 Rudder control horn
71 Port elevator construction
72 Tailplane rib construction
73 Rudder hinge mounting
74 Tailplane attachment frame
75 Rubber block tailskid shock absorber
76 Tailplane tubular steel leading edge
77 Tailplane bracing strut
78 Castoring tailskid
79 Fuselage bottom longeron
80 Vertical spacers
81 Tailplane control cables
82 Fuselage ventral fabric lacing
83 Wing rear spar
84 Trailing-edge ribs
85 Box-section compression ribs
86 Front spar
87 Inter-spar diagonal wire bracing
88 Upper aileron interconnecting cables
89 Aileron control horn
90 Port upper aileron construction
91 Steel tube trailing edge
92 Aileron
93 Port lower aileron
94 Aileron diagonal bracing ribs
95 Wooden leading edge and wing tip
96 Outboard interplane struts
97 Diagonal wire bracing
98 Lower wing panel rib construction
99 False centre spar
100 Centre interplane struts
101 Pitot tube
102 Boarding step



103 Fuselage fabric lacing panel
104 Wing spar root attachment joints
105 Wing footsteps
106 Skid rear bracing struts
107 Main undercarriage leg strut
108 Shock absorber fairing
109 Elastic cord shock absorber
110 Port mainwheel
111 Wheel hub fixing
112 Wheel disc fabric cover

Tabloid No. 326 was in the hands of the Central Flying School in December 1914.

Sopwith Tabloid

Compact Package

Harry Hawker's diminutive Tabloid had limited combat utility, although participated in some memorable early actions of the air war.

First flown in November 1913 by HHawker, who is credited with leading the design team, the Tabloid prototype had side-by-side seating and skid landing gear. It was a conventional-looking biplane with its tractor engine enclosed by an unusual pointed cowl that left only three cylinders of its 100hp (76kW) Gnome Monosoupape engine exposed.

In floatplane configuration it won the Schneider Trophy at Monaco in April 1914 averaging 85.403mph (137.442km/h) over a 100km course. The victory was more a testament to reliability than performance as all but one of the other competitors pulled out with mechanical difficulties.

The first six production aircraft retained two seats, while the Tabloid SS was the single-seat variant very similar to the prototype, with wing warping, although later examples had ailerons on the upper wings. The new wheeled undercarriage incorporated skids to prevent it tipping over on landing.

Tabloids were issued to No. 5 Squadron at Netheravon in June 1914 and to Nos. 3 and 4 on the Western Front before year's end, these being mixed units operating a variety of types.

In late August, a Tabloid scored one of the first RFC victories of the war when Lt Norman Spratt brought down a German aircraft by means of circling above and throwing steel darts at it. He reportedly also tried attacking enemies with a grenade attached to a cable.

Only about 40 Tabloids were built, of which three were transferred to the RNAS, and on 9 October 1914 Naval Wing pilots conducted the type's most famous mission when two of them flew from besieged Antwerp to attack airship sheds at Cologne and Dusseldorf. Sqn Cdr Spenser Grey failed to find the target but bombed Cologne's main station. Tabloid 168 piloted by Lt Reginald Marix bombed the sheds from 600ft (180m) and destroyed the new Zeppelin *Z.9*. Both RNAS aircraft were forced to land short of their base, but the pilots made it to Antwerp and were evacuated before it fell. Otherwise, the RFC realised that the Tabloid had limited operational value and they were withdrawn from front line service in the spring of 1915.

The Lebed VII and VIII were unlicensed Russian copies of the Tabloid. Intended for use as a two-seat fighter, most wound up as trainers. ■

Sopwith Tabloid

Crew: One
Length: 20ft 4in (6.20m)
Wingspan: 25ft 6in (7.80m)
Height: 8ft 5in (2.57m)
Empty weight: 730lb (331kg)
Max T/O weight: 1,120lb (508kg)
Powerplant: One Gnome Monosoupape piston engine rated at 100hp (76kW)
Max speed: 93mph (150km/h)
Service ceiling: unknown
Range: 510 miles (820km)
Armament: Personal weapons; up to five 20lb bombs

Scout C No. 1607 was delivered in May 1915 with an 80hp Gnome engine. It was struck off after an accident in October 1916.

Bristol Scouts

First Pursuit

The Scout began as a fast reconnaissance machine before becoming one of the first British single-seat fighters.

Bristol's Baby Tractor biplane was flown at Larkhill on 23 February 1914. It had equal-span, staggered wings with ailerons on upper and lower surfaces. The engine was an 80hp (60kW) Gnome, part of which was exposed by a semi-circular metal cowling and aluminium panels extended to the sides of the cockpit.

Bristol built two improved versions with larger wings and a circular cowl and delivered these to the RFC in late August 1914. They were issued to frontline squadrons (Nos. 3 and 5) in France, where they proved popular with pilots.

The Baby was retrospectively designated the Scout A and the next two were Scout Bs with a wider undercarriage. They lasted as late as September 1915, by which time nine later examples were serving with eight squadrons in France alongside other types. As a reconnaissance aircraft, the Scout was not originally fitted with weapons, but various lash-up arrangements of carbines and even shotguns were fitted by enterprising pilots and ground crew. In March 1916 the first example with a Vickers gun and Vickers-Challenger interrupter gear was sent to France. This was known as the Scout D.

There were various other machine-gun installations on Scouts, including overwing mounts. Some fired through the propeller arc, but without synchronisation gear, bullets inevitably hit the blades. The solution was to patch them up if there were only two or three holes, and discard them if there was more damage.

The top-scorer on the Scout alone was Charles Bell, who claimed five enemy aircraft while with No. 10 Squadron. In May 1916. Albert Ball VC scored his first victory of an eventual 44 while flying a Scout of No. 11 Squadron

Scouts served with RFC and RNAS units in Mesopotamia, Palestine, Macedonia, and in the Aegean. A single RAF Home Defence squadron and ten RNAS Defence Flights flew Scouts over the U.K. The RNAS Scouts were based at coastal air stations and equipped with Ranken darts for anti-Zeppelin defence. These would be dropped from above and hopefully ignite after piercing the airship's fabric.

Relatively few Scouts were ordered: 161 Scout Cs and 210 Ds. Bristol chose to concentrate its efforts on F.2 Fighter production and licence-production of other types. By the summer of 1916, Scouts were withdrawn from the Western Front and relegated to training in Britain. ■

Bristol Scout D

Crew: One
Length: 20ft 8in (6.30m)
Wingspan: 24ft 7in (7.49m)
Height: 8ft 6in (2.59m)
Empty weight: 760lb (345kg)
Max T/O weight: 1,440lb (653kg)
Powerplants: One Le Rhône radial piston engine rated at 80hp (60kW)
Max speed: 110mph (177km)
Duration: 2.5 hours
Armament: Various, but usually one 0.303in Vickers machine-gun

No. 3066 was one of more than 120 RNAS Caudron G.3s, which were mainly used for training in France.

Caudron G.3 and G.4

Lattice Tails

The fragile-looking Caudrons were not high-performance aircraft, but served the RFC and RNAS in a number of roles, including reconnaissance, bombing and training

Société des Avions Caudron at Romiotte built several tractor-engined designs which had a central nacelle and the tail mounted on struts, a configuration more common with pusher types. The ends of the struts doubled as landing skids. In 1913 the War Office bought several Caudron biplanes with 45hp (34kW) tractor engines to boost aircraft numbers to match the strength they had stated to the government. At least two were issued to No. 4 Squadron but seem to have had little use.

The G.3 was the most important of the single-engined Caudrons, powered by Renault, Gnome, Le Rhône, Renault or Anzani engines of between 70hp (52kW) and 100hp (76kW) output. The parent company built 1,423 of them and more were completed by the British Caudron Company at Cricklewood.

The RFC initially used the G.3 mainly for reconnaissance, distributing them around various units including Nos. 1, 4 and 5 Squadrons in France. Some were later dispatched to Mesopotamia, but most of the 55 aircraft in RFC service were used for training in France and England.

The RNAS had one G.3 on strength at the beginning of the war, but subsequently acquired around 125 examples from the manufacturer for training, mostly equipping schools in France.

The twin-engined G.4 was a derivative of the G.3 design, with a fuselage of similar length, but a wingspan of 55ft 6in (and two 80hp (60kW) Le Rhône or 100hp (76kW) Anzani engines. The RFC received two for evaluation but did not adopt the type, whereas the RNAS acquired 55 G.4s, 12 of them built by British Caudron. Assigned to Nos. 4 and 5 Wings in France, they flew day and night bombing missions against enemy airfields, seaplane bases and Zeppelin hangars with a load of up to 249lb (113kg) of bombs. Various armament combinations were tried, including a pivoting Lewis gun in the forward cockpit, and another gun mounted to fire rearwards over the upper wing.

The Caudrons gained a reputation at unit level for being reliable with good climbing performance, but higher-ups regarded the supply of them as mainly useful for the engines. The G.4 left operational service by the autumn of 1917, replaced by Handley Page O/100s. ■

Caudron G.3

Crew: Two
Length: 22ft 6in (6.89m)
Wingspan: 43ft 5in (13.26m)
Height: 8ft 6in (2.59m)
Empty weight: 959lb (435kg)
Max T/O weight: 1,619lb (734kg)
Powerplant: One Gnome rotary piston engine rated at 80hp (60kW)
Max speed: 70mph (113km/h)
Service ceiling: 10,000ft (3,048km)
Endurance: 3hr 30min
Armament: Various personal weapons

The first production F.B.5, No. 1616, seen at Farnborough in December 1914. It was issued to No. 5 Squadron in France in April 1915 and served with them until wrecked in September. *Air Historical Branch*

Vickers Pusher Fighters

Gunbuses

The F.B.5 'Gun Bus' (or 'Gunbus') was the first aircraft specifically designed as a fighter. Somewhat underpowered and vulnerable from the rear, its operational career was short.

Vickers created its first gun-armed pusher biplane at Admiralty request in 1913. Some time after it crashed on its first take-off attempt, it was designated E.F.B.1. Later refinements were tested by the War Department as the F.B.2 through F.B.7, and these joined the RFC from September 1914, with one later passing to the RNAS. These early pushers were kept in England for training and home defence. One may have shot down a German Taube that crossed the Channel in December 1914.

A separate development was the two-seat E.F.B.5, powered by a 100hp (76kW) Gnome Monosoupape engine. Based on an aircraft delivered to the RNAS in September 1914 that was retrospectively called the Vickers Type 32, the E.F.B.5 was an equal-span biplane with the observer seated at the front and handling either a belt-fed Vickers gun or a Lewis gun with a drum magazine.

The E.F.B.5 became the F.B.5, but was known as the Vickers Fighter or 'Gun Bus', although the latter seems never have been used in contemporary documents.

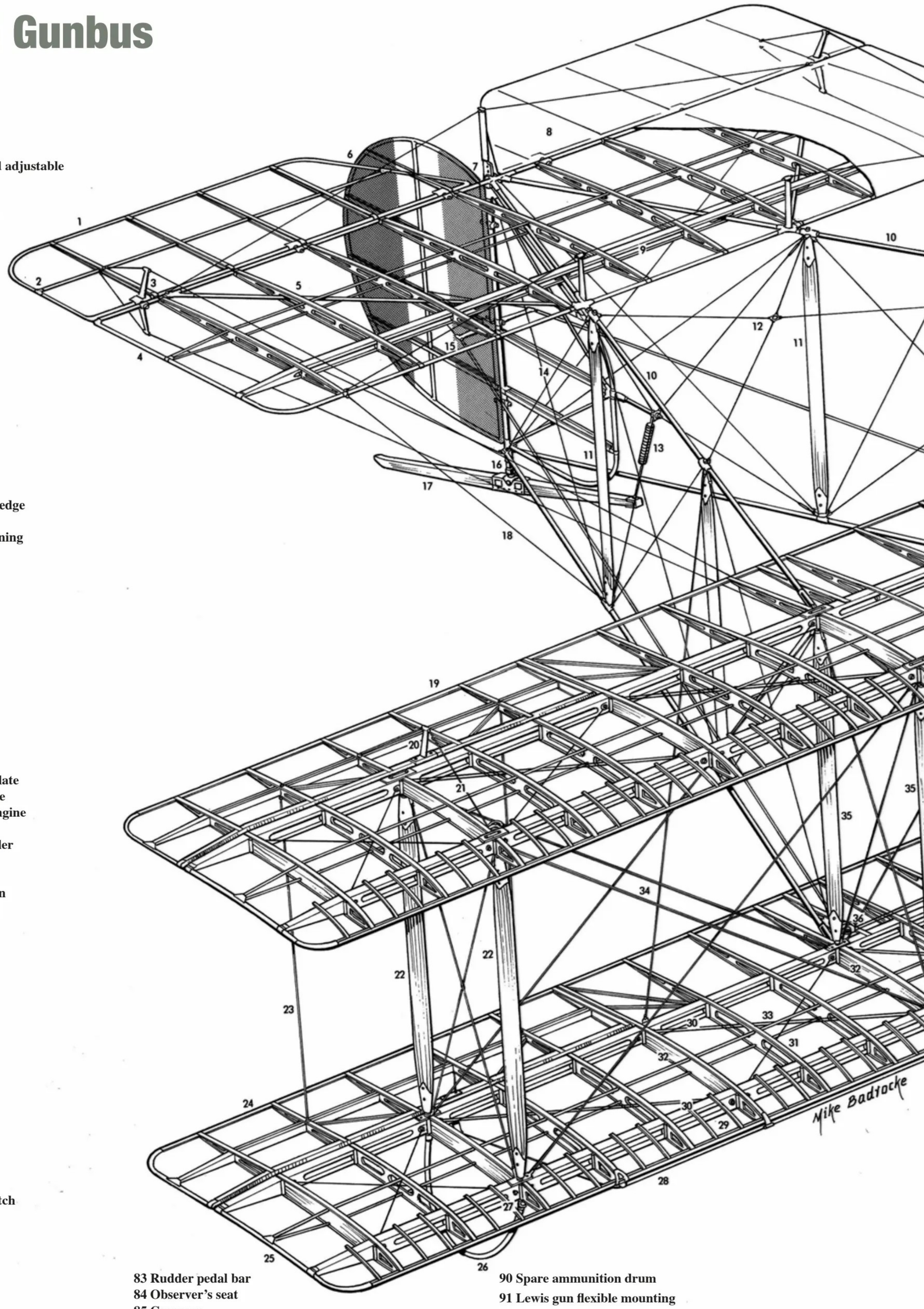
The first F.B.5 flew to France on 5 February 1915 and was with with No. 2 Squadron when it force-landed behind German lines on 2 March. No. 5 Squadron was the first to field the type in numbers, receiving nine between March and June, but No. 11 Squadron became the RFC's first ever fully-equipped fighter squadron in July. The unit tried a variety of armament installations, including a supplemental Lee-Enfield rifle for the observer and a machine-gun mount between the cockpits, which could be fired by either occupant.

The Darracq motor company contracted with Vickers to build the F.B.5 in France with an order for 50 for the RFC and 12 for the RNAS soon following, although deliveries were slow. Total F.B.5 production eventually amounted to 99 from Darracq, 119 by Vickers and 18 by Neilson and Winthers in Denmark.

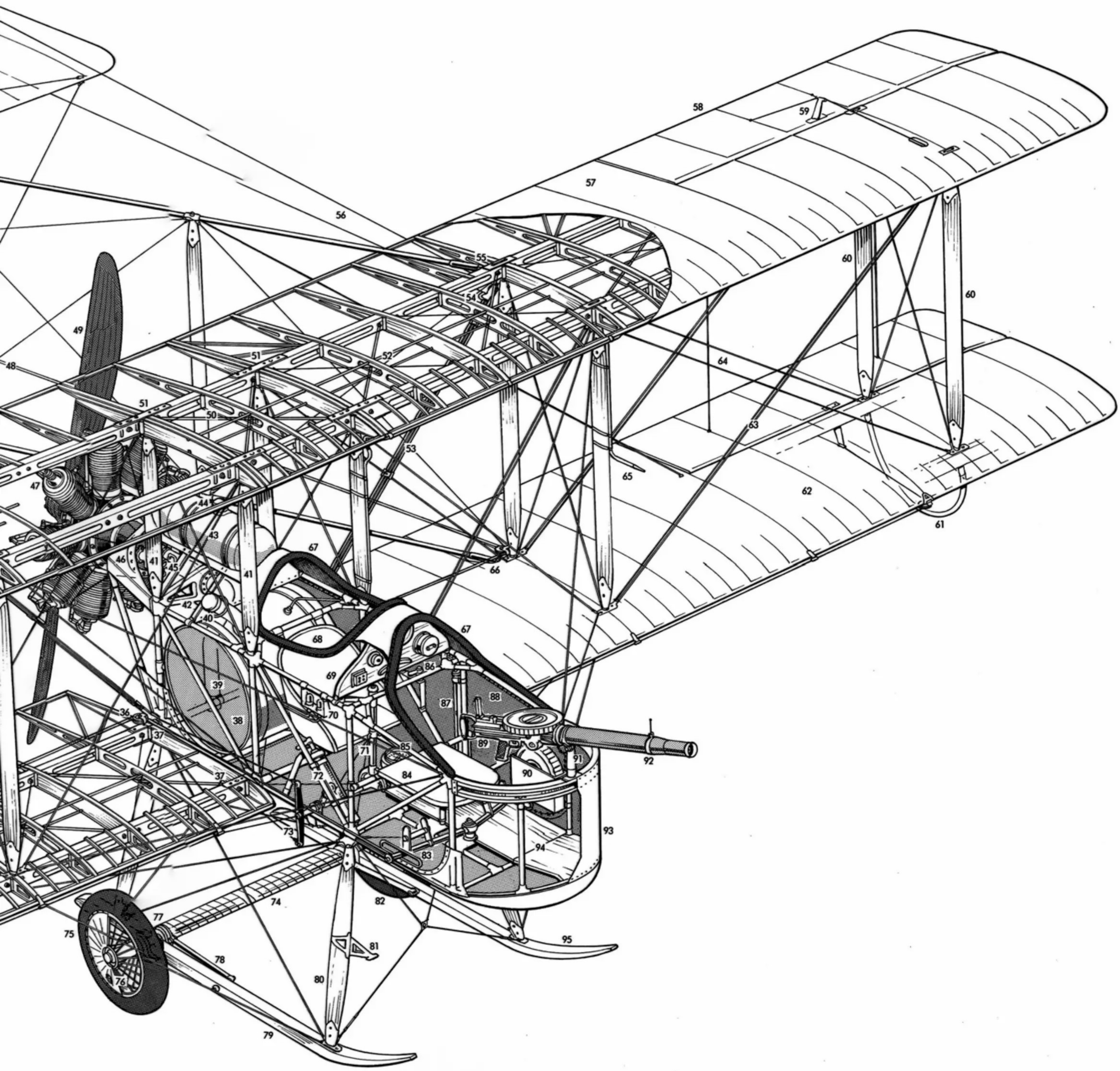
On 7 November 1915, 2nd Lt Gilbert Insall and mechanic T.H. Donald of No. 11 Squadron forced down an Aviatik near Arras. Flying low to drop incendiary grenades on it, they were hit by ground fire and forced to land themselves just inside British lines. Despite enemy artillery fire falling around them, they repaired their aircraft and flew back to their home airfield. For this action, Insall was awarded the Victoria Cross and Donald the Distinguished Conduct Medal in December, but by this time they had been shot down and were in German captivity, from which Insall escaped in August 1917.

F.B.5s achieved few aerial victories. Frederick Powell of No. 5 Squadron was the top-scorer,

Vickers FB.5 Gunbus



1 Starboard elevator
2 Steel tube elevator framework
3 Elevator control horn
4 Tailplane steel tube edge member
5 Tailplane rib construction
6 Rudder
7 Tailplane incidence adjustment, ground adjustable
8 Port fabric-covered elevator
9 Tailplane main spar
10 Tubular steel tailplane support booms
11 Vertical spacers
12 Diagonal wire bracing
13 Tailskid shock absorber spring
14 Fixed tailfin
15 Rudder control horn
16 Tailskid pivot mounting
17 Ash tailskid
18 Tailplane cable bracing
19 Starboard upper elevator
20 Aileron control horn
21 Aileron balance cable
22 Outboard interplane struts
23 Aileron interconnecting cables
24 Starboard lower elevator
25 Wingtip edge member
26 Bamboo cane wingtip protecting skid
27 Tie-down point
28 Aileron operating cable along leading edge
29 Leading-edge riblets
30 Spruce wing spars, spindled for lightening
31 Wing panel plywood ribs
32 Compression ribs
33 Wing panel internal wire bracing
34 Interplane wire bracing
35 Inboard interplane struts
36 Rudder cable pulleys
37 Spar root attachment joints
38 Fuel tank, 50 Imp gal
39 Carburettor intake duct
40 Fuel filler cap
41 Centre-section cabane struts
42 Rear engine mounting frame
43 Engine oil tank
44 Oil filler cap
45 Engine accessories mounted on backplate
46 Main engine mounting steel ring frame
47 100hp Gnome Monosoupape rotary engine
48 Dual rudder cables
49 Two-bladed laminated wooden propeller
50 Upper wing panel centre-section
51 Bolted spar root joints
52 Port upper wing panel rib construction
53 Elevator cables following lifting wires
54 Cable pulley block
55 Tailboom attachment joint
56 Port elevator cables
57 Wing panel upper fabric covering
58 Port upper aileron
59 Aileron control horn
60 Interplane struts
61 Port wingtip skid
62 Port lower wing panel
63 Double lifting wires
64 Single flying wires
65 Pitot
66 Lower tailplane boom attachments
67 Padded leather cockpit coaming
68 Pilot's seat
69 Instrument board
70 Engine oil feed sight glasses
71 Control column with engine bleed switch
72 Fuel pressurisation hand pump
73 Elevator cable bellcrank
74 Faired axle beam
75 Starboard mainwheel
76 Wheel disk fabric cover
77 Elastic cord shock absorber
78 Radius rod
79 Ash main undercarriage skid
80 Undercarriage support struts
81 Boarding step
82 Port mainwheel
83 Rudder pedal bar
84 Observer's seat
85 Compass
86 Engine throttle valve
87 Fuel contents sight glass
88 Fuselage sidewall fabric covering
89 0.303in Lewis gun
90 Spare ammunition drum
91 Lewis gun flexible mounting
92 Gun barrel cooling jacket
93 Aluminium front fairing panels
94 Plywood floorboards
95 Port undercarriage skid


36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95

MORE MAGAZINES: XSAVA.XYZ

The prototype F.B.5, later numbered 7665, demonstrates how priority was given to a clear field of fire for the forward-mounted machine-gun in the pusher designs. *NASM*

albeit with only two confirmed kills on the F.B.5 of his wartime total of six.

The F.B.5 gained a reputation for being slow and having a poor climb rate, taking 30 minutes to reach 9,000ft (2,743m). It was vulnerable to attack from the rear and against the likes of the Fokker Eindecker, it stood little chance and was soon replaced by more advanced single-seat fighters like the D.H.2.

Vickers tried to get more life out of the basic design with the F.B.9, which had a longer nacelle, rounded wingtips, a simpler undercarriage and other refinements. It was generally slightly smaller and lighter and consequently was faster with a higher ceiling. Vickers built 95 F.B.9s at its Crayford and Weybridge factories, but only No. 11 Squadron received any number of them, the majority being assigned to training units.

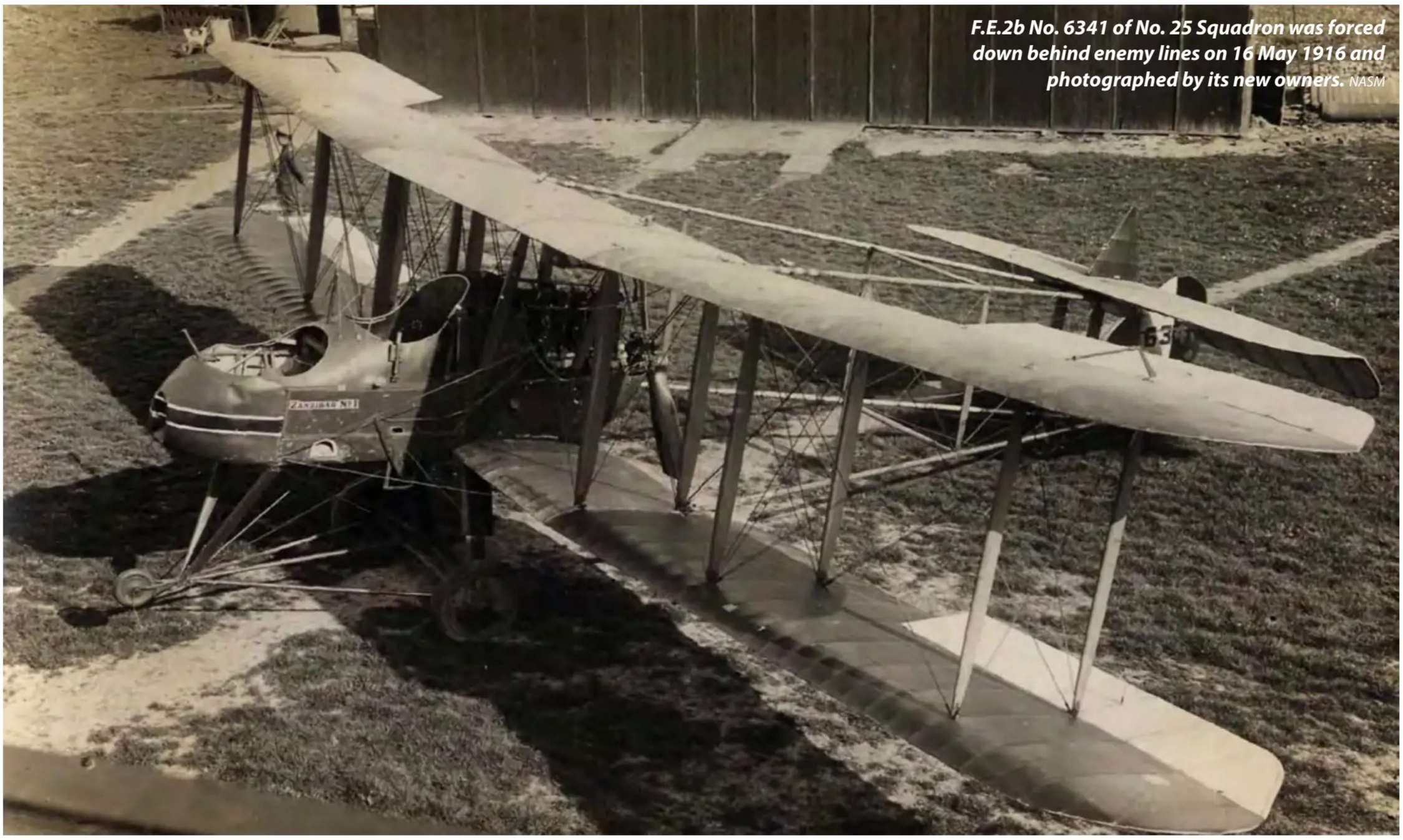
In early 1916 work began on a new Vickers pusher able to take on the superior German fighters. It was intended that the F.B.12 would use a 150hp (112kW) Hart nine-cylinder radial, but this engine proved a failure and the 80hp (60kW) Le Rhône was initially substituted for the prototype, but production aircraft used the 100hp (80kW) Gnome Monosoupape, then a 100hp Le Rhône and finally an Anzani of the same power. None of these propelled the aircraft faster than 100mph (160km/h). The single-seat F.B.12 was armed with one Lewis gun protruding through the front of the nacelle. Only 17 were built, and none is believed to have seen service in France. ■

The single-seat F.B.12 was obsolescent by the time it appeared in mid-1916.

USMC Archives

Vickers F.B.5

Crew: Two
Length: 27ft 2in (8.28m)
Wingspan: 36ft (11.13m)
Height: 11ft 6in (3.51m)
Empty weight:
Max T/O weight: 2,050lb (930kg)
Powerplant: One Gnome Monosoupape 9-cylinder radial piston engine rated at 100hp (76kW)
Max speed: 70mph (113km/h)
Service ceiling: 9,000ft (2,743m)
Endurance: 4hrs 30min
Armament: One or two



F.E.2b No. 6341 of No. 25 Squadron was forced down behind enemy lines on 16 May 1916 and photographed by its new owners. NASM

Royal Aircraft Factory F.E.2

The 'Fee'

With its forward-firing armament, the pusher-prop F.E.2 was one of the first successful British fighters, although it was soon outclassed by German single-seaters.

Geoffrey de Havilland's F.E.1 design of 1910 was designated a 'Farman Experimental' because of its similar configuration to Farman biplanes. It was rebuilt after a crash as the F.E.2 and then crashed again, but the name was reused for a new design, the F.E.2a fighting scout, which first flew in early 1915. This was a large two-bay biplane with a pusher propeller and the observer manning a Lewis gun from a position ahead of and below the pilot's cockpit.

After 12 F.E.2as with the unsatisfactory 100hp (76kW) Green engine, production switched to the F.E.2b with a 120hp (90kW) Beardmore. Deliveries to No. 6 Squadron in France began in May, followed by Nos. 20, 22 and 25, in time to tackle the 'Fokker Scourge'. One of the notable early successes was the downing of German ace Max Immelmann by a 25 Squadron crew on 18 June 1916.

There were more than 40 aces on the F.E.2. Observer Francis Cubbon was credited with 21 victories while flying F.E.2ds with No. 20 Squadron in April-June 1917, all but one of them Albatros D.IIIs. His pilot for most of these was James Thayre, who was credited with 19 kills.

The first kill credited to Manfred von Richthofen was an F.E.2d in September 1916, and he downed another dozen of the type by the end of April 1917. It was not all one way – the 'Red Baron' himself was wounded in a dogfight with No. 20 Squadron F.E.2ds in July.

Only two F.E.2c night fighters with the pilot and observer positions reversed were built. The F.E.2d introduced the Rolls-Royce Mk. III Eagle engine of 250hp (187kW) in an attempt to match the performance of the new German fighters, but they were soon outclassed by the Albatros fighters with twin synchronised machine-guns. One desperate self-defence measure was a second gun on a telescopic mounting between the seats that the observer could fire over the wing, if he stood up in the cockpit facing backwards.

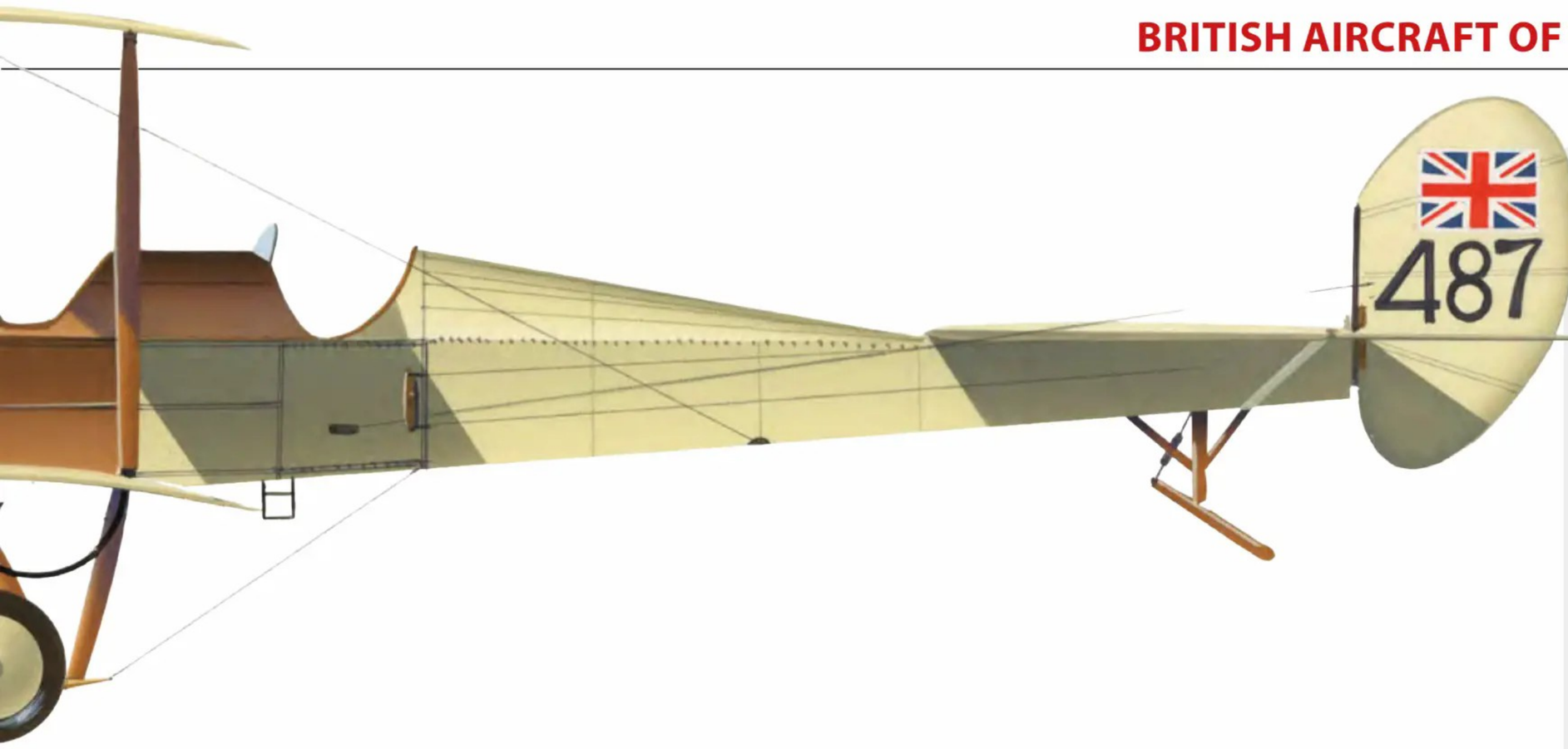
The F.E.2d was increasingly used as a night bomber, for which it proved quite effective. It was decreasingly useful as a fighter and in this role was relegated to anti-Zeppelin patrols in England, where some aircraft were converted to single-seaters with twin fixed Lewis guns in the nose. They failed to destroy any Zeppelins.

Production amounted to 1,939 F.E.2s from the Royal Aircraft Factory and five other sub-contractors. A few F.E.2s remained in service at the Armistice. ■

Royal Aircraft Factory F.E.2d

Crew: Two
Length: 32ft 3in (9.83m)
Wingspan: 47ft 9in (14.55m)
Height: 12ft 8in (3.86m)
Empty weight: 2,509lb (1,138kg)
Max T/O weight: 3,469lb (1,574kg)
Powerplant: One Rolls Royce Mark III piston engine rated at 250hp (187kW)
Max speed: 94mph (151km/h)
Service ceiling: 17,500ft (5,334m)
Endurance: 2hr 30min
Armament: Two or three 0.303in Lewis machine-guns; up to six 20lb bombs

2757

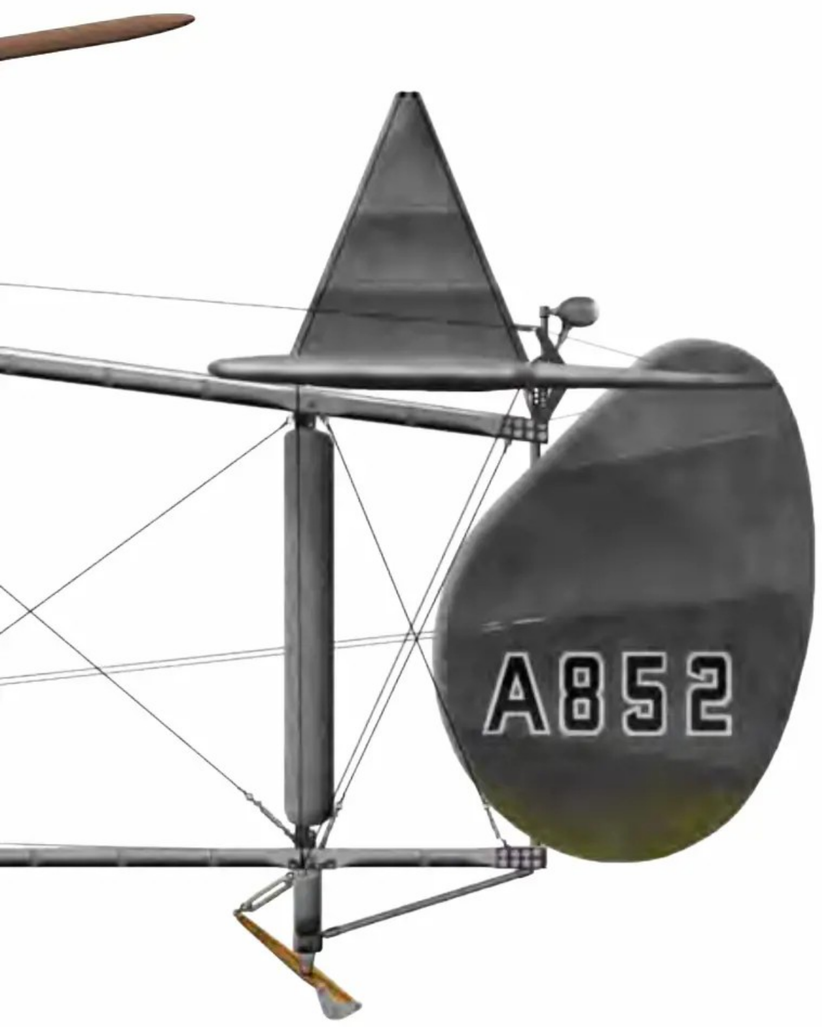


Royal Aircraft Factory B.E.2b 487
No. 4 Squadron, Royal Flying Corps
Poperinghe, Belgium
1915

Built at Farnborough in August 1914, Renault-engined B.E.2b No. 487 was sent overseas in September, being taken on strength by No. 4 Squadron, which moved to Poperinghe on 21 October. After flying a number of reconnaissance sorties, 487 was under rebuild by the Air Park for around six weeks before returning to the squadron. On 11 March 1915 it was reported missing on operations.

Royal Aircraft Factory B.E.2c 2757
No. 8 Squadron, Royal Flying Corps
La Bellevue, France
1916

Taken on charge 20 May 1916, B.E.2c 2757 was presented by the people of Saran in Bihar, India, through the District Officer, F. M. Luce. It was issued to No. 8 Squadron, which was tasked with long-range reconnaissance missions, on 30 May. On 18 July 1916 2nd Lt Reginald Holloway and his observer 2nd Lt H.S. MacNeil were injured when 2757 crashed into a house near Bailleulmont during a test flight. It was struck off charge two days later.



Avro 504K F9754
No.7 (Training) Squadron,
Australian Flying Corps
Leighterton, Wiltshire
1918

The Australian Flying Corps formed its own squadrons in the UK in 1918, Nos. 7 and 8 arriving at Bowldown Farm (later AFC Leighterton) in late February 1918. They used a variety of types including the Avro 504, R.A.F. B.E.2c, R.E.8 and Bristol F2.B. Avro 504K F9754 was built by Hewlett and Blondeau to a contract for 100 and arrived at 7FTS on 26 October 1918. It was last recorded on 8 February 2019.

Royal Aircraft Factory F.E.2b
No. 100 Squadron,
Royal Flying Corps
Ochey, France
January 1918

Completed by G & J Weir, Cathcart, Glasgow and taken on charge in April 1917, A852 served with No. 100 Squadron as a night bomber on long-range missions into Germany. During an attack on Trier railway station on 21 January 1918, it struck a balloon cable and was hit by ground fire. The crew of 2nd Lt Louis Taylor and Lt F.E. LeFevre, MC were declared missing and the aircraft was struck off 24 January. Taylor and LeFevre were captured and were repatriated at the end of the war.

Seen fitted with 100lb bombs, Type 184 No. 8076 was built by Shorts and powered by a Maori I or II engine.

Short 184

The First Torpedo Bomber

Short's Type 184 was the most successful and numerous British floatplane of the war, serving in many theatres and performing heroic missions in a variety of roles.

Several companies were approached by the Admiralty in 1914 to build a floatplane able to carry a 14-in torpedo. Short Brothers' offering was deemed the most suitable and 12 aircraft had been ordered for evaluation before the first flew, in early 1915. This aircraft was given the military serial 184 and from that, all that followed were known officially as the Admiralty Type 184, or Short 184, although some documents refer to it as the Short 225, because of its original 225hp (168kW) Sunbeam Mohawk engine.

The wings had an unusual taper from the tip to the roots. There were large ailerons on the upper wings and later aircraft had smaller ailerons on the lower wings as well. The wings could be folded back for hangar stowage. There were twin wooden main floats, a single tail float and wingtip bag floats. The observer was equipped with a Lewis gun and a box of carrier pigeons.

More than 650 Type 184s were built by Short and sub-contractors including Westland, Phoenix Dynamo, Saunders, Robey, Sage and Mann, Egerton. Various engines were fitted, including 240hp (179kW) Sunbeam Gurkhas or Renaults, 260hp (194kW) or 275hp (205kW) Sunbeam Maori I, II or IIIs.

Type 184s operated in the North Sea, Aegean and Mediterranean and also operated from the River Tigris during the Mesopotamia campaign, at one point air-dropping supplies to a besieged garrison at Kut.

Operating from the seaplane carrier HMS *Ben-my-Chree* in the Adriatic, the Short 184 carried out its most famous missions. On 12 August 1915, Flt Cdr Charles Edmonds made the first ever operational torpedo attack, striking a Turkish ship. He repeated this feat five days later, disabling a freighter. Flt Lt George Dacre launched a torpedo while taxying on the water, sinking a Turkish tug and escaping under heavy fire. Flight performance with a torpedo was marginal, and the 184 was mainly switched to bombing and reconnaissance missions.

The Type 184 played a crucial role in the Battle of Jutland in May 1916. Launched from the seaplane carrier HMS *Engadine*, 184 No. 8359 scouted ahead of the Royal Navy's battle-cruisers. Pilot Frederick Rutland approached as close as he could the German fleet and observer George Trewin radioed back the numbers and types of ships spotted while facing heavy anti-aircraft fire. Rutland was awarded the DSC for his part in the battle and was forever after 'Rutland of Jutland'.

After the war the Type 184 was mainly used for duties such as mine spotting until the last were retired in 1920. ■

Short Type 184

Crew: Two
Length: 40ft 8in (12.38m)
Wingspan: 63ft 6in (19.36m)
Height: 13ft 6in (4.11m)
Empty weight: 3,703lb (1,680kg)
Max T/O weight: 5,560lb (2,522kg)
Powerplant: One Sunbeam piston engine rated at 260hp (194kW)
Max speed: 88mph (142km/h)
Service ceiling: 9,000ft (2,745m)
Endurance: 2hr 45min
Armament: One 0.303 Lewis machine-gun; one 14in Whitehead torpedo or 520lb (236kg) of bombs

A rare inflight photo of a D.H.2 above an airfield somewhere in France. It is probably a squadron commander's aircraft judging by the pennant flying from the wing struts.

Airco D.H.2

Push it Good

The agile D.H.2 with its forward-firing gun helped level the odds in the skies over France and was involved in many epic combats before the balance shifted again with the arrival of new German fighters.

The Aircraft Manufacturing Company (usually known as Airco) was formed by George Holt Thomas in 1912 in order to produce and sell Farman designs. They hired Geoffrey de Havilland from the Royal Aircraft Factory in June 1914. His first design for Airco was a two-seat pusher with the observer located at the forward end of the nacelle where he had a clear field of fire. The engine and propeller were mounted behind the cockpit, necessitating a 'birdcage' frame aft fuselage. The chosen powerplant was the 120hp (90kW) Beardmore, but the unavailability of this saw substitution with a 70hp (52kW) Renault for the prototype, which de Havilland himself flew in January 1915.

The Beardmore became available after production began, and aircraft so powered were designated D.H.1a. Most were built by Savages Ltd. in Norfolk and issued to Home Defence squadrons or training units. Only six were sent overseas, to No. 14 Squadron in Egypt. Total production of D.H.1s and D.H.1as was 72.

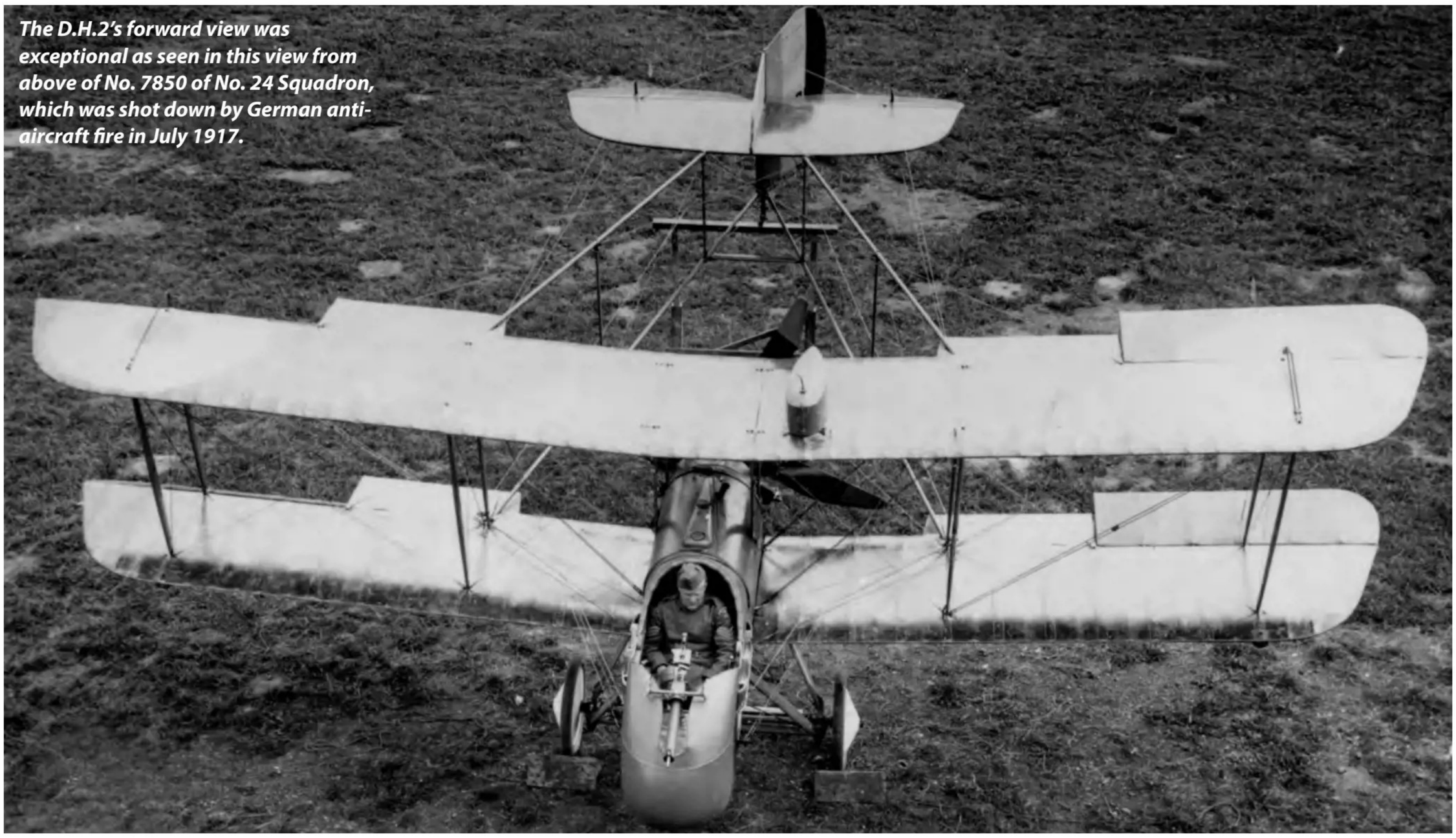
Even while the D.H.1/1a was being developed, Geoffrey de Havilland was working on a more nimble version for air combat. The D.H.2 was much smaller than the D.H.1a, with a wingspan 13ft (3.96m) less and a 100hp (76kW) Gnome Monosoupape engine. It was a single-seater with two gun mountings in front of the cockpit, but only one gun. The busy pilot was expected to move the Lewis gun between them as required, but this idea was soon dropped in favour of a single fixed mounting. There was some vertical movement of the gun possible, but in general pilots learned to aim the whole aircraft at the target, transforming air combat.

First flown on 1 June 1915, it was not until February 1916 when the first examples of the D.H.2 reached the front with No. 24 Squadron. Two more squadrons, Nos. 29 and 32, followed soon after, and began to turn the tide of air superiority over the Western Front. The commander of No. 32 Squadron, Major Lionel Rees, fought an engagement with ten German AGO bombers on 21 September 1915, claiming two driven down. Wounded in the leg and running out of Lewis gun ammunition, he grabbed a revolver, but dropped it in the cockpit. Finding another ammo drum, Rees expended it on an enemy aircraft before returning to Allied lines. For this and other actions, Rees was awarded the Victoria Cross.

Lt Patrick Langan-Byrne of No. 24 Squadron was the top-scoring D.H.2 pilot with ten victories before he was shot down by Oswald Boelcke

Airco D.H.2

Crew: One
Length: 25ft 3in (7.68m)
Wingspan: 28ft 3in (8.61m)
Height: 9ft 7in (2.91m)
Empty weight: 943lb (428kg)
Max T/O weight: 1.441lb (654kg)
Powerplant: One Gnome Monosoupape nine-cylinder rotary piston engine rated at 100hp (76kW)
Max speed: 93mph (150km/h)
Service ceiling: 14,000ft (4,267m)
Endurance: 2hr 45min
Armament: One 0.303in Lewis machine-gun, up to 460lb (208kg) of bombs



The D.H.2's forward view was exceptional as seen in this view from above of No. 7850 of No. 24 Squadron, which was shot down by German anti-aircraft fire in July 1917.

on 16 October 1916. Boelcke himself was killed when his Albatros D.II collided with his wingman while both manoeuvred to attack D.H.2s of No. 24 Squadron on 28 October.

Flying an Albatros D.II, Manfred von Richthofen claimed four D.H.2s, one of which was flown by the commanding officer of No. 24 Squadron, Major Lanoe Hawker, VC, who was killed on 23 November 1916.

The D.H.2 was regarded as difficult to fly, if manoeuvrable and sturdy, but it was soon surpassed by newer German fighters. From early 1917, squadrons began to re-equip with tractor-engined types with synchronised machine-guns, including the D.H.5 and Nieuport 16. Some remained in use in Palestine and with training units but by August 1918 the D.H.2 was out of service. ■

Thought to be in Egypt or Palestine, this scene shows a mechanic hand-turning a D.H.2's pusher propeller while another prepares to hold it back against the thrust. *Air Force Museum of New Zealand*

This Schneider was still active when photographed in late September 1918. *USMC Archives*

Sopwith Floatplanes

Sea-going Pioneers

The Tabloid racing floatplane was developed into the Schneider and Baby combat aircraft for the Navy, performing some world-first missions from ships at sea.

After success at Monaco with the Schneider Trophy-winning Tabloid floatplane, the RNAS adopted the type as the Schneider, of which 36 were ordered from November 1914. Carried by various types of ship and craned into the water for launch, the Schneiders were used unsuccessfully to intercept German airships over the North Sea. To counter rough seas, which frequently prevented take-off, wheeled dollies were sometimes used. So fitted, a Schneider launched from the deck of HMS *Campania* on 6 August 1915, arguably making the ship the world's first aircraft carrier.

Scneiders were used in the Mediterranean, including the Dardanelles campaign, and are credited with shooting down at least one Turkish aircraft with an overwing-mounted Lewis gun.

With a 110hp (82kW) Clerget engine replacing the Monosopaupe, the Schneider became the Admiralty Type 8200 or Baby, which was delivered to the RNAS from September 1915. The tapered cowling was exchanged for a more typical Sopwith semi-circular unit.

The first batch of Babies had a Lewis gun mounted to aim above the wing. Later aircraft had 130hp (97kW) Clerget motors and some had Rankin anti-Zeppelin darts in place of the machine-gun. Others had a Lewis gun synchronised to fire through the propeller arc.

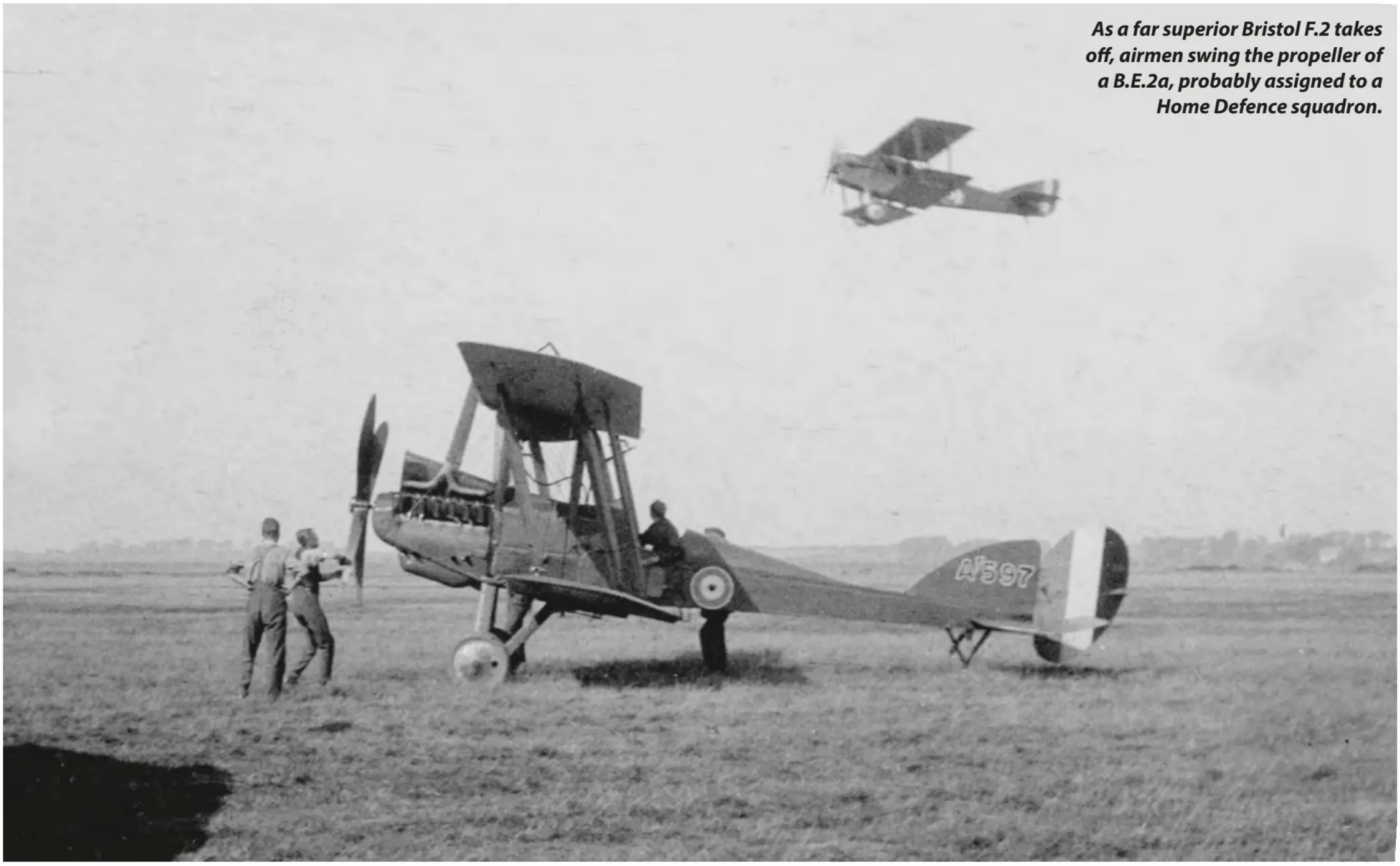
The Baby was involved in some of the first sea-launched strategic air raids in history. In blizzard conditions on 24 March 1916, two Babies and three Short 184s flew from HMS *Vindex* against the Zeppelin hangars on the North Sea coast. The exact location of the base was unknown, but was located at Tondern. No damage was caused and both Babies force-landed on the sea. A Type 184 tried to rescue one pilot, who held on to the wing, but it too suffered engine failure and was eventually captured. One Baby was recovered and flown by the Imperial German Navy.

HMS *Vindex* launched 11 Babies against Tondern on 4 May 1916, but eight failed to leave the water, one crashed into an escorting destroyer and one aborted with engine trouble. Only one dropped bombs, unfortunately on neutral Denmark.

The Royal Australian Navy borrowed one Baby from the RN and operated it from the cruiser HMAS *Brisbane* while searching for the German raider SMS *Wolf* in the Indian Ocean in the spring of 1917. This was the RAN's first involvement in naval aviation. ■

Sopwith Baby

Crew: One
Length: 23ft 0in (7.01m)
Wingspan: 25ft 8in (7.82m)
Height: 10ft 0in (3.05m)
Empty weight: 1,226lb (556kg)
Max T/O weight: 1,715lb (778kg)
Powerplant: One Clerget rotary piston engine rated at 130hp (97kW)
Max speed: 100mph (162km/h)
Service ceiling: 10,000ft (3,048m)
Endurance: 2hrs 15min
Armament: One 0.303 Lewis machine-gun; two 65lb bombs; Rankin anti-Zeppelin darts



As a far superior Bristol F.2 takes off, airmen swing the propeller of a B.E.2a, probably assigned to a Home Defence squadron.

Royal Aircraft Factory B.E.12

Makeshift Fighter

Created from the stately B.E.2, the B.E.12 was not much use in dogfighting, but its stability and climbing performance suited it to night interception missions.

In mid-1915 the toll being taken on RFC aircraft by the Fokker monoplanes saw an urgent request for a single-seat fighting type to counter them. The Royal Aircraft Factory responded by adapting a B.E.2c two-seater, by covering over the observer's cockpit and installing a 150hp (112kW) R.A.F.4a engine. Otherwise the first aircraft was largely identical to the B.E.2.

The B.E.12, converted from Bristol-built B.E.2c No. 1697, flew in late July 1915. Production versions had single-bay wings, tall twin exhaust stacks and a large air scoop, which faired into an extra petrol tank ahead of the cockpit. Armament was a single Vickers gun with Vickers interrupter gear mounted on the left side of the fuselage. Some aircraft had one or two Lewis guns aimed so that they fired outside of the arc of the four-bladed propeller and a few even had a rearward-firing Lewis gun.

Production was sub-contracted to the Coventry Ordnance Works, Daimler and Standard Motors, which together produced 600 examples.

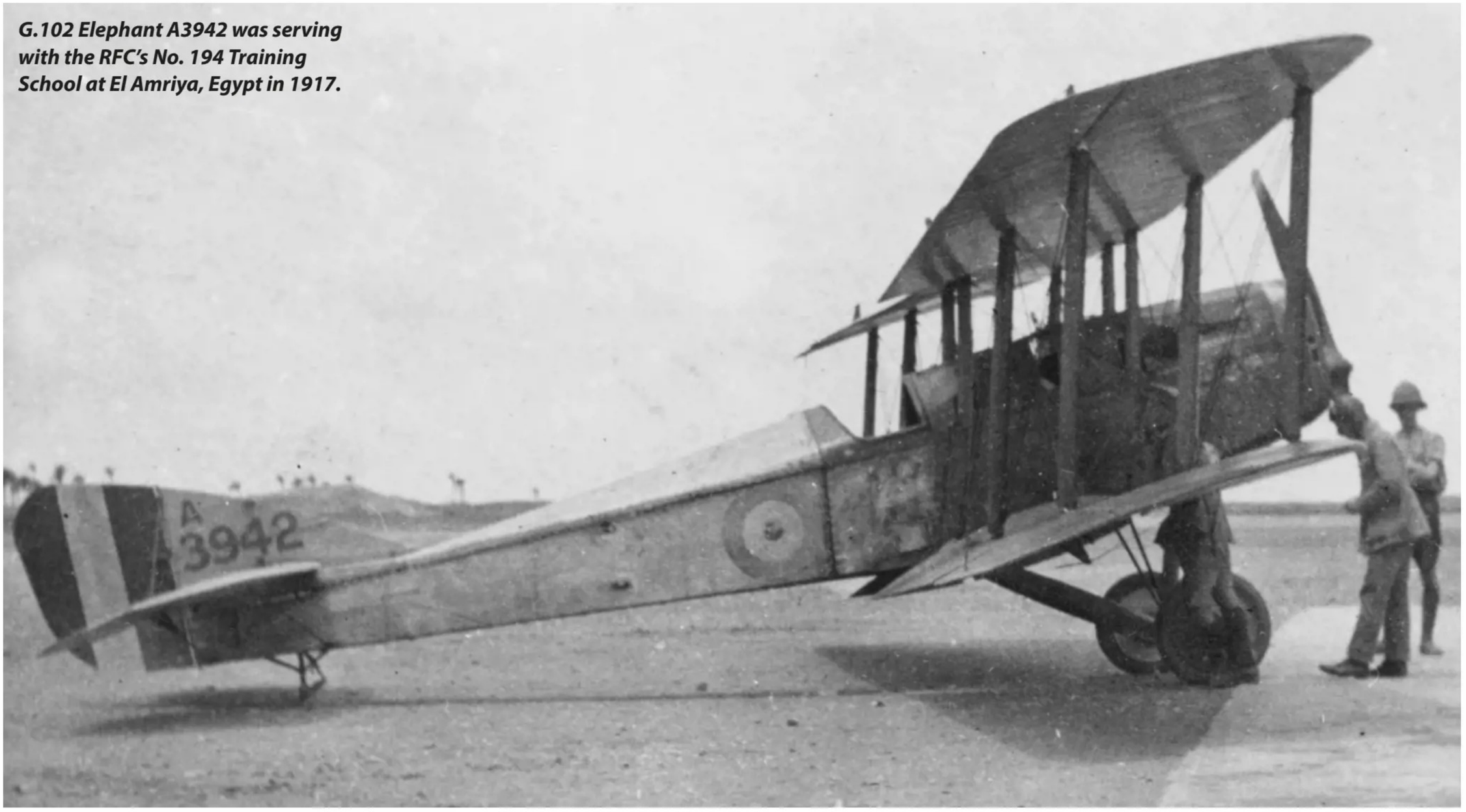
The B.E.12 reached the front in August 1916 with Nos. 16 and 21 Squadrons. Too stable to be a fighter, the B.E.12 was quickly relegated to photographic and bombing duties, and then withdrawn to Home Defence Squadrons.

The B.E.12 also saw some service in the Mediterranean. Gilbert Murlis-Green, flying with No. 17 Squadron at Salonika, shot down six German aircraft, mainly two-seaters, but also one Albatros D.V. He was the only ace on the type. Cecil Lewis said of the B.E.12: "It really was a cow. The engine gave full revs and full power while sounding as if there was something radically wrong with it." An attempt to improve manoeuvrability by using the top wing of the B.E.2e created the B.E.12a. The B.E.12b was optimised for night-fighting with a 200hp (149kW) Hispano-Suiza engine and twin Lewis guns mounted over the top wing. One gun was fitted with a Hutton illuminated sight.

On 17 June 1917, Zeppelin *L-48* was attacked by a variety of aircraft over Suffolk. Flying a B.E.12, Lt L. P. Watkins of No. 37 (Home Defence) Squadron struck the final blow and was credited with its destruction. This was probably the highlight of the B.E.12's career. Only about 17 were in active service at the war's end. ■

R.A.F B.E.12

Crew: One
Length: 27ft 3in (8.31m)
Wingspan: 37ft (11.28m)
Height: 11ft 2in (3.39m)
Empty weight: 1,635lb (742kg)
Max T/O weight: 2,352lb (1,054kg)
Powerplant: One R.A.F.4a 12-cylinder piston engine rated at 140hp (104kW)
Max speed: 102mph (164km/h)
Service ceiling: 12,500ft (3,810m)
Endurance: 3hr
Armament: One 0.303in Vickers machine-gun and one or two Lewis guns



G.102 Elephant A3942 was serving with the RFC's No. 194 Training School at El Amriya, Egypt in 1917.

Martinsyde G.100 and G.102

'The Elephant'

One of the largest single-seaters of the era, the G.100 and the slightly faster G.102 were mediocre fighters and undistinguished bombers.

George Harris Handasyde and Helmut Paul Martin formed a company in 1908: Martin and Handasyde, abbreviated to Martinsyde. After the S.1, a small fighter resembling the Sopwith Tabloid, Anthony Fletcher designed a much larger single-seater. In August 1915 the prototype G.100 flew at Brooklands with a 120hp (90kW) Beardmore engine and a three-bladed propeller; production aircraft had a two-bladed prop. Ailerons were fitted on both upper and lower wings. Armament was a single Lewis gun on the centre section of the top wing, which could be swung down for changing the ammunition drum.

G.100s were issued to two-seater reconnaissance and bombing squadrons as escorts. They were also used for reconnaissance themselves, although there was barely room in the cockpit for a map, let alone a camera or wireless set. With its large size for a single-seater, the G.100 acquired the nickname 'The Elephant', which remained unofficial.

Arriving in France in March 1916, No. 27 Squadron was the only one on the Western Front to be exclusively equipped with G.100s and adopted an elephant as its squadron emblem, which remains in use to this day. The long endurance and good carrying capacity showed promise for bombing duties, and Elephants were modified to carry eight 20lb bombs under the inner wings Some were further strengthened to lift eight more under the centre-section and had a braced undercarriage. This bombing capability was first employed at the beginning of the Somme offensive in July 1916.

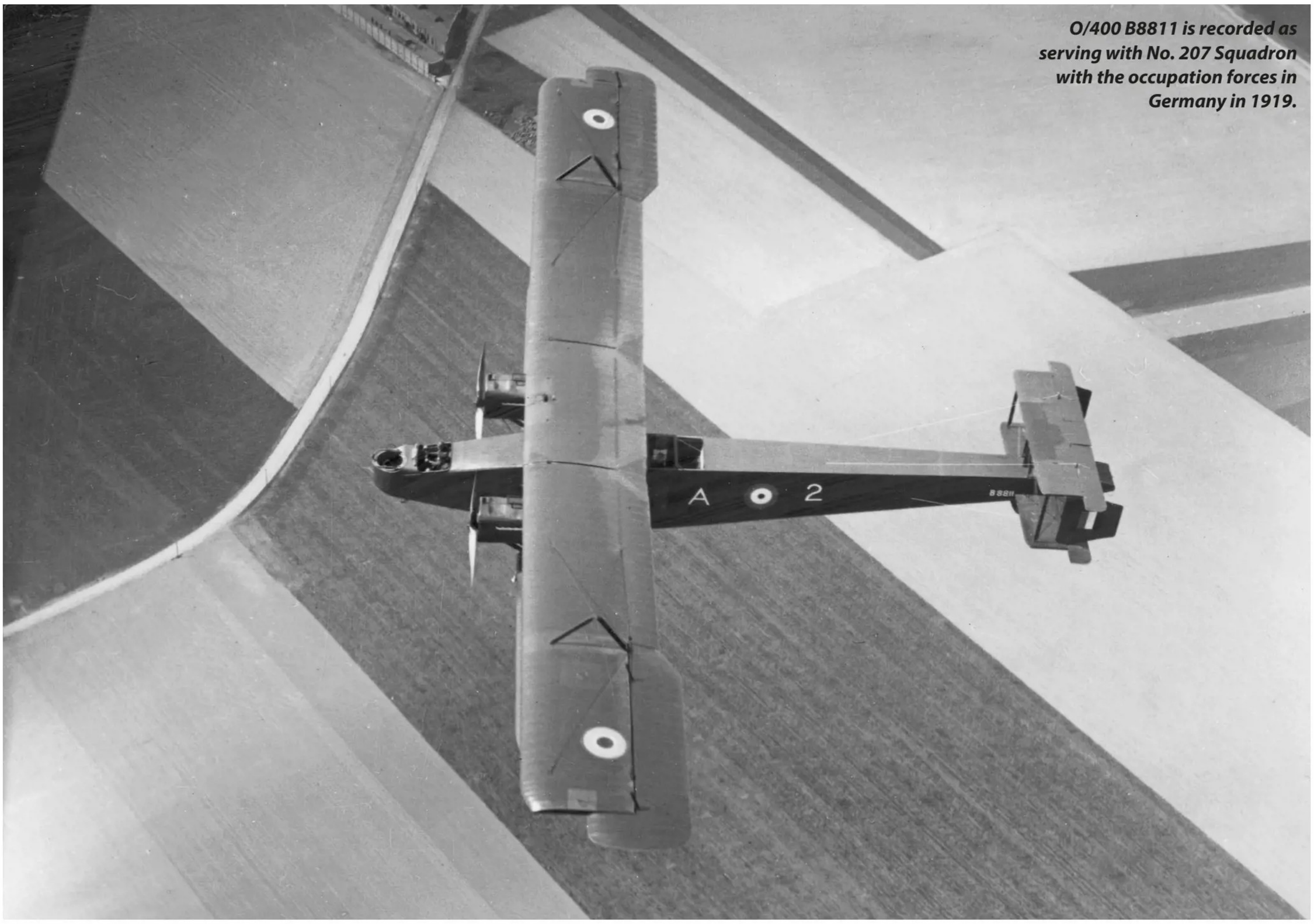
Being cumbersome and having no rear gunner, the Elephant was vulnerable to enemy fighters. The broad wings and high cowling restricted the pilot's view. Many Elephants were fitted with a fixed rear-facing Lewis gun on the port side of the cockpit. This could not really be aimed by the pilot and at best had a 'scare' effect on an attacker. Two aces, Douglas Bell (20 victories) and John Gilmour (39), scored three kills each with the Elephant but the majority on the Sopwith Camel. No. 27 Squadron gave up its Elephants in December 1916, having lost 26 pilots and more aircraft.

The G.102 was powered by a 160hp (119hp) Beardmore. This was less reliable than the lower-powered version, but speed increased by about 7mph (11km/h), while endurance reduced by an hour. Total production of the two types amounted to 271.

Elephants remained in use in Palestine and Mesopotamia by No. 67 (Australian) Squadron RFC and Nos. 14, 30 and 72 Squadrons into 1919, frequently bombing railways to hamper Turkish troop movements. They also formed part of 'Dunsterforce', a small unit sent to fight Ottoman and Bolshevik troops in Persia and Southern Russia in 1918. ■

Martinsyde G.100

Crew: One
Length: 26ft 7in (8.10m)
Wingspan: 38ft 0in (11.84m)
Height: 9ft 8in (2.95m)
Empty weight: 1,759lb (814kg)
Max T/O weight: 2,424lb (1,100kg)
Powerplant: One Beardmore six-cylinder inline piston engine rated at 120hp (90kW)
Max speed: 95mph (153km/h)
Service ceiling: 16,000ft (4,877m)
Endurance: 5hr 30m
Armament: One or two 0.303in Lewis machine-guns; up to 336lb (152kg) of bombs



O/400 B8811 is recorded as serving with No. 207 Squadron with the occupation forces in Germany in 1919.

Handley Page O/100 and O/400

'Bloody Paralyser'

The heaviest bombers to see action in World War I were the twin-engined O/100 and O/400, which turned the RFC into a true strategic air force.

The origins of the Handley Page 'giants' of World War I and beyond can be traced back to the L/200, a large single-engined aircraft designed in 1913 to win the prize for the first Atlantic crossing. The outbreak of war in August 1914 quashed that plan, but Handley Page had solved many of the structural problems of large aircraft and when the Admiralty's Commodore Murray Sueter requested in December a 'Bloody Paralyser' to attack the German Navy, the company was ready to submit a response.

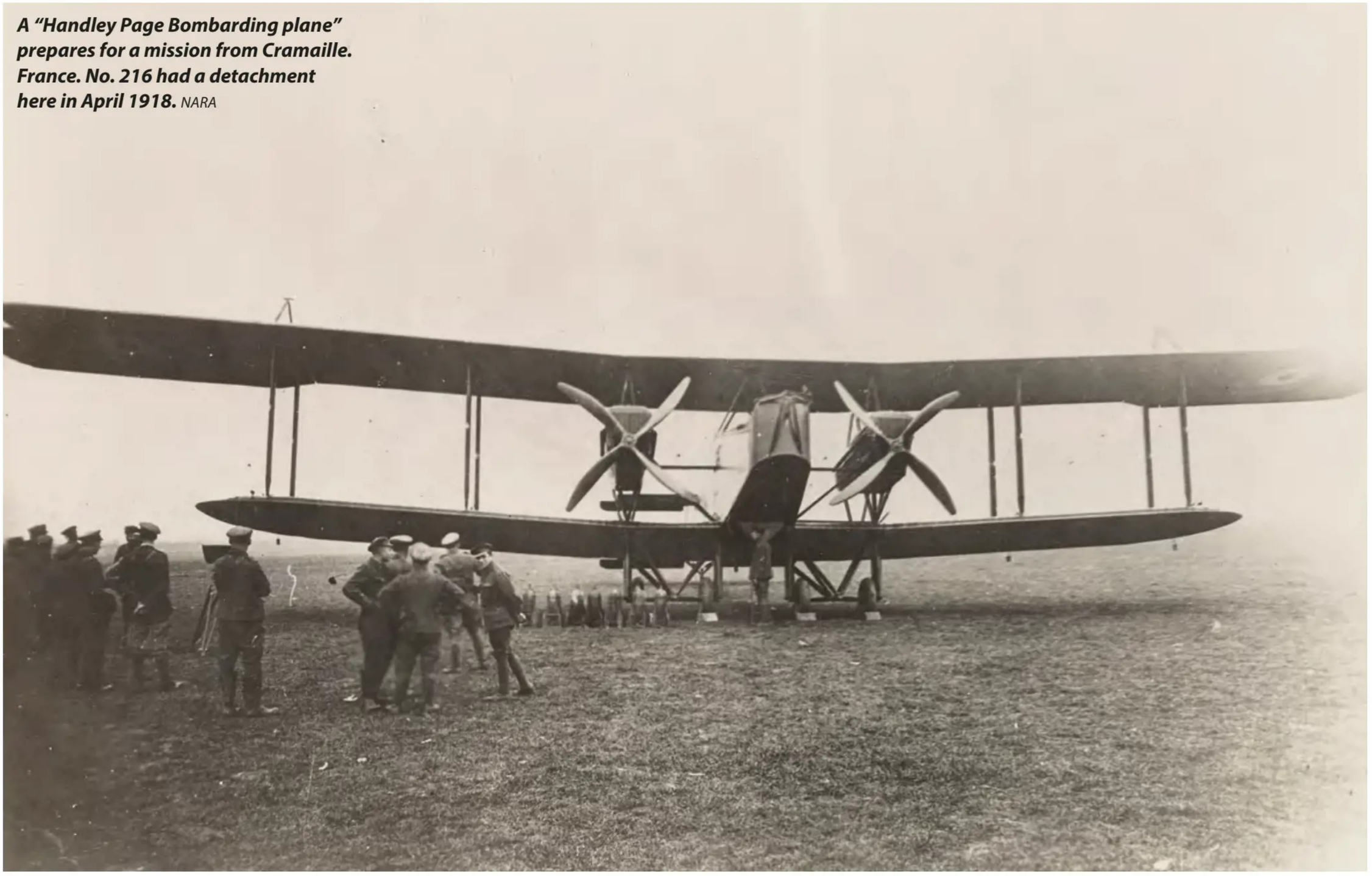
Frederick Handley Page and George Volkert redesigned their transatlantic machine as the twin-engined O/100 to meet the specification for an aircraft with two 150hp (112kW)Sunbeam engines able to carry six 100lb bombs to 3,000ft (914m) in ten minutes. This was an ambitious requirement for an aircraft of the day, but weight was saved by specifying only two crew and defensive armament of one Lee Enfield rifle.

Unusually for the time, the nacelles, enclosed crew cabin and windscreens were to be given a degree of armour protection, with a manganese-steel floor and sidewalls. A bomb load of up to 16 112lb bombs could be carried vertically within the centre-section. The bombs fell tail-first onto spring-loaded doors, pushing them open. The unequal-span three-bay wings with huge ailerons (on the upper wings) could fold backwards to allow hangar stowage. The fuselage was essentially a cross-braced box girder and the tail was a biplane structure with a central fin and two rudders. The elevators overhung the tailplane noticeably. The nacelles initially had side-mounted radiators, and they contained most of the fuel supply in long extensions. The steel tube undercarriage stood on two pairs of wheels.

One year after the initial proposal, the prototype (No. 1455) flew on 17 December 1915 at Hendon in the hands of Lt Cdrs John Babbington and Ernest Stedman. By this time, Rolls-Royce had developed its 250hp (186kW) Rolls-Royce Eagle II engine, and these were substituted for the Sunbeams.

The armoured cockpit enclosure was soon dispensed with but the fourth prototype introduced proper defensive armament in the form of nose, dorsal and ventral gun positions. An initial batch of 42 aircraft was ordered and a unit named the Handley Page Squadron was established under 3 Wing RNAS at Luxeuil.

In December 1916 the first four O/100s were despatched to the front, but unfortunately, one landed at an enemy aerodrome by mistake. This was flown to Germany, but crashed before



A "Handley Page Bombarding plane" prepares for a mission from Cramaille. France. No. 216 had a detachment here in April 1918. *NARA*

O/400 D5423 was issued to No. 115 Squadron at Castle Bromwich in July 1918. The squadron moved to Roville, France in August and the bomber was "wrecked" on a raid against Mohrange aerodrome on 21 September. *NARA*

This image shows O/400 C9704 with its wings folded and gives a good view of the sturdy four-wheel main undercarriage. Aircraft of this batch used the Rolls-Royce Eagle VIII engine.

evaluation could take place. Joined (on the right side of the lines) by four more in April, the huge bombers were at first employed on anti-shipping patrols. In June 1917 No. 3 Wing was disbanded and the surviving aircraft were transferred to 5 Wing and No. 7 (Naval) Squadron. Although a raid buy four O/100s sank a German destroyer and crippled another, one was lost to anti-aircraft fire and the mission was changed to night attacks on rail targets, dockyards and industry. New 520lb and 550lb bombs were used against reinforced submarine pens. The O/400 could also carry the 1,650lb SN bomb, which was first employed in March 1918 against a target in West Flanders. Only about a dozen were used in the war.

To counter subs at sea, four O/400s were equipped with the Davis 6-pounder gun, a weapon that balanced its recoil by propelling a lump of grease and lead shot backwards when it fired. This was hard to reload in flight, proved hazardous to anyone behind it, such as the pilot, and did not sink any U-boats.

One aircraft (No. 3124) was flown to the Aegean island of Mudros to make attacks against Constantinople, Turkey. On 9 July 1917, an eight-hour mission succeeded in damaging a German cruiser and hitting the Turkish War Office. After further raids, the one-aircraft bombing campaign ended when an engine failure forced 3124 to ditch. The crew swam ashore and were captured. Pilot Jack Alcock later became famous in 1919 when he and Arthur Whitten Brown made the first transatlantic crossing by aeroplane.

A new fuselage fuel system and compressed air starting were installed on one O/100 in September 1917, and it was redesignated the O/400. Various engine installations appeared on the O/400s, including the Sunbeam Maori, Fiat A.12bis and Hispano-Suiza, although most retained Eagles. O/400s equipped the new Independent Force of the RAFwhich formed in April 1918). They were used in small numbers until 14 September when 40 were despatched against six targets. Three were lost and nine returned early. In total 69 Handley Pages were lost or wrecked in 1918. Production totalled 663 O/400s and 46 O/100s.

After the war, some were converted for use as O/7 16-seat airliners. In the USA 107 Liberty-engined O/400s were built, all but eight for use by the RAF. ■

Handley Page O/400

Crew: Four
Length: 62ft 10in (19.15m)
Wingspan: 100ft (30.48m)
Height: 22ft 0in (6.71m)
Empty weight: 7,894lb (3,580kg)
Max T/O weight: 14,020lb (6,359kg)
Powerplant: Two Rolls-Royce Eagle II V-12 piston engine rated at 250hp (186kW)
Max speed: 85mph (137km/h)
Service ceiling: 7,000ft (2,134m)
Endurance: 8hrs
Armament: Four or five 0.303in machine-guns; bomb load up to 1,800lb (816kg)

Strutter B762 was a 'Comic' night-fighter conversion with twin Lewis guns aimed at a 70-degree angle. It is known to have served with No. 78 Squadron.

Sopwith 1 1/2 Strutter

Fighter-Bomber

Sopwith's Strutter pioneered the two-seat fighter with guns for both crew members. It was also one of the first aircraft to be embarked aboard major warships.

The Sopwith Two-Seater or LCT (for Land, Clerget, Tractor) was more commonly known as the 1 1/2 Strutter a reference to the length of the members of the W-shaped supports for the centre wing section.

The Strutter first flew in mid-December 1915 and deliveries began to the Royal Naval Air Service (RNAS) in February 1916 where they were put into use on the Western Front as light bombers by Nos. 2, 4, , 7 and 8 Naval squadrons. Most were soon transferred to the Royal Flying Corps' (RFC's) bombing squadrons (Nos. 37, 43, 45, and 84), and from October operated alongside French Breguet bombers. It also flew with Nos. 44 and 78 (Home Defence) Squadrons. The Strutter could be described as the first fighter-bomber as it was the first British aircraft to be equipped with a synchronised forward-firing machine-gun and was also effective in the air-to-air role. The top Strutter ace was Geoffrey Hornblower Cock of No. 45 Squadron who brought down 13 enemy aircraft in April-July 1917.

The Strutter's observer had a Lewis gun, initially on a Scarff pillar mount, later on a Nieuport ring and then on the famous Scarff ring mounting. Strutters had several innovative features including a type of airbrake in the trailing edges of the lower wingroots and a tailplane that was adjustable in flight.

Some Strutters were converted to single-seaters, which could carry 224lb (102kg) of small bombs in a 12-cell bay that replaced the observer's position. Two-seaters were restricted to 130lb (59kg) payloads on external racks.

The Strutter was the first British ship-borne aircraft, with RNAS aircraft flying from platforms atop the gun turrets of battleships. The US Navy also flew Strutters briefly from the battleships *Arizona*, *Nevada*, *Oklahoma*, *Pennsylvania* and *Texas*. The US Army Air Service acquired 518 Strutters (130 of them single-seaters) from the French in spring 1918. They saw some action but were mainly used as trainers.

Many Strutters were exported during and after the war, to countries such as Belgium, Romania, Japan and Latvia. Japan is said to have used them against the USSR during its 1918 Siberian expedition. British-built examples numbered 1,513 or more. It is said that 4,500 others were built in France, and an unknown number in Russia, where they were used until at least 1925. ■

Sopwith 1 1/2 Strutter

Crew: One
Length: 25ft 3in (7.69m)
Wingspan: 33ft 6in (10.21m)
Height: 10ft 3in (3.12m)
Empty weight: 1,305lb (592kg)
Max T/O weight: 2,149lb (975kg)
Powerplant: One Clerget 9B nine-cylinder rotary piston engine rated at 130hp (97kW)
Max speed: 100mph (161km/h)
Service ceiling: 15,000ft (4,570m)
Endurance: 3hr 45min
Armament: One 0.303in Vickers machine-gun; bomb load up to 224lb (102kg)

BINKY
III
N5449
LIFT HERE
LIFT HERE
THE
SOPWITH
AVIATION Company Ltd
KINGSTON ON THAMES
R
8239D
LIFT HERE
LIFT HERE

Sopwith Triplane N5449
8 (Naval) Squadron, Royal Naval Air Service
Mont St. Eloi, France
1917

Sopwith-built N5449 joined No. 8(N) Squadron on 28 February 1917, and was named 'Joan'. It turned over on landing on 15 March and shot down an Albatros on 3 May. At some point renamed 'Binky III', it force-landed after being hit by ground fire on 10 August. Transferred to No. 1 (Naval) Squadron, it scored two further victories in the hands of Canadian pilot Lt Anthony Spence, who was eventually credited with nine.

SPAD S.VII, B6732
No.23 Squadron, Royal Flying Corps
Matigny, France
February 1918

No. 23 Squadron received S.VIIs in February 1917 and operated them until May 1918. They wore the standard French colour scheme with the white triangle close support marking. B6732 was shot down north of Leon on 26 February 1918 by a JG 2 Fokker Dr.1 piloted by Adolf von Tutschek, the 24th of his 27 victims. 2nd Lt David Colquhoun Doyle was wounded in the foot and made prisoner of war. The aircraft force-landed with little damage.

Sopwith 1.F1 Camel D8239
No. 28 Squadron, Royal Air Force
Sarcedo, Florence, Italy
1918

Built by Ruston, Proctor and Co in Lincoln, Clerget-engined Camel D8239 (presented as 8239D), was taken on charge in May 1918 and sent to Italy. It was mainly flown by Canadian Capt. Clifford 'Black Mike' McEwan, who scored 27 victories, four of them in D8239 in July-September 1918. It is believed the chequered cowling was added after the war's end.

Royal Aircraft Factory S.E.5a E5765
No. 2 Squadron, Australian Flying Corps
Pont-A-Marcq, France
November 1918

Wolseley Viper-engined S.E.5a E5765 was built by the Austin Motor Co in Birmingham. It was assigned to A Flight of No. 2 Squadron, AFC on 21 October 1918. The A Flight commander was Capt. Ernest Davies, who scored seven victories flying the S.E.5A, including three in E5765 in October. It crashed at Aire, near Marquise, on 15 February 1919 and was struck off charge.

Seen escorting a convoy, C.23A operated for nearly 1,000hrs before it was wrecked on 10 May 1918 off Newbury. *USMC Archives*

His Majesty's Airships

Battlebags

British airship construction fell far behind that of Germany in both numbers and quality. While the German Zeppelin and Schütte-Lanz airships were strategic bombers, the Royal Navy used airships mainly for coastal patrol.

Both the British Army and Royal Navy built airships before World War One, mostly experimental machines. The Navy took over all development on 1 July 1914. The Army line ended with *Eta* in 1913, which was handed over to the Navy as His Majesty's Airship *No. 20* the following January. This airship introduced the so-called 'Eta-patch', a method of attaching the control car that did away with an elaborate harness and long extensions to prevent the envelope from sagging.

The first of the RNAS's own airships, H.M.A. No. 1 *Mayfly* was 512ft (156m) long and powered by a pair of 200hp (149kW) Wolseley engines. Although successfully inflated and moored in May 1911, the dirigible failed to live up to the promise of its name and was blown into the side of its hangar while being manoeuvred out on 24 September. The damage was too extensive and *Mayfly* was broken up.

Based on plans of a Zeppelin that force-landed in France in 1913, H.M.A. *No. 9r* flew in November 1916. This experimental craft formed the basis of H.M.A. No. 23r in October 1917 and subsequent airships: Nos. *24r*, *25r*, *R.26*, *R.27* and *R.29*. The latter was the Royal Navy's most successful operational airship, attacking three German submarines on 29 September 1918, chasing one off, driving another into a minefield where it struck a mine and hitting a third with a 220lb bomb. *UB-115* was then sunk by destroyers.

As part of experiments to provide a means of self-escort, *No. 23r* was fitted with Little-Crook Anchoring Gear, which allowed fighter aircraft to be carried and launched. Successful tests took place with a Sopwith Camel on 3 November 1918, but were abandoned with the Armistice. It was not until 1925 that attempts to reconnect a fighter in flight were made.

Main airship bases included East Fortune near Edinburgh, Longside, Aberdeenshire; Howden, Yorkshire; Mullion, Cornwall, Pulham, Norfolk and Kingsnorth, Kent. These were equipped with large sheds, but airships could also be 'moored out', connected to masts at airfields, fields or even quarries.

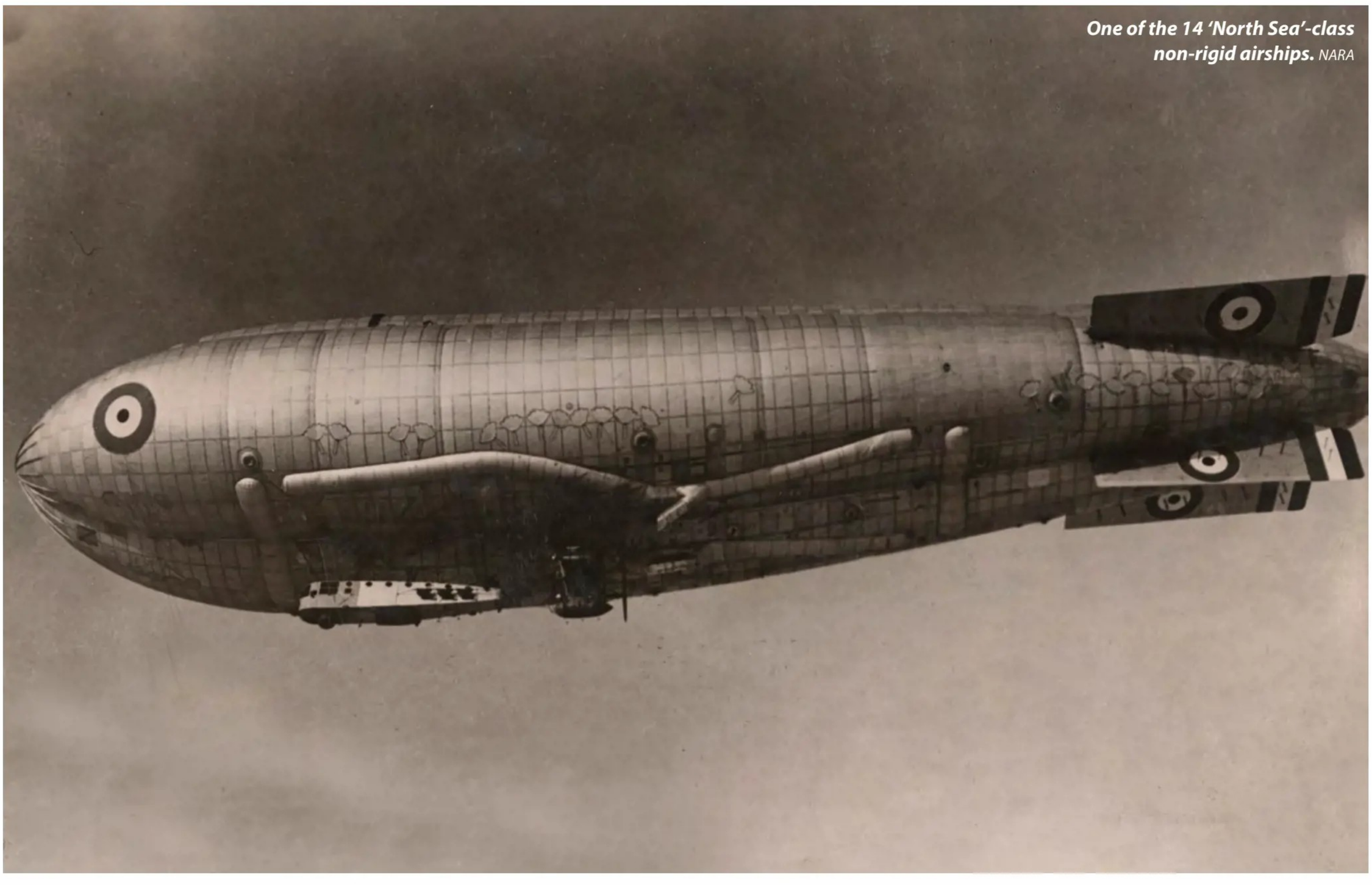
The 'Sea Scout' or 'SS'-class airships were commissioned in 1915 for anti-submarine patrol. The first of these was produced by the simple expedient of suspending a B.E.2 fuselage, complete with engine and propeller, from the envelope of an older airship. Later examples used Maurice Farman or Armstrong-

Coastal airship C.25 was flown in late 1916. It disappeared on 31 July 1918, probably shot down by a U-boat. *USMC Archives*

Whitworth FK.3 fuselages. There were 49 SS-class ships built, and one AP-1, which was a complete B.E.2c attached to an SS envelope by a quick-release harness. The idea was that the combination could loiter at altitude and the aircraft would disconnect to attack Zeppelins without the need to climb when one was detected. Unfortunately during the first full release test, the aeroplane became tangled in the harness. The pilot was thrown out and the B.E.2c crashed with the helpless observer.

Although the 'SS' airships provided a presence over coastal waters and gave useful training, a more useful design was needed, resulting in the twin-engined 'Coastal' class.

As with the earlier craft, the control cars were designed around obsolescent aircraft fuselages. Two Avro 510 seaplane cockpits were acquired and joined back-to-back, making a four-seater with pusher and tractor engines. This was attached to the envelope of *SS-10* and tested in May 1915. The crew consisted of a coxswain, pilot, wireless operator and engineer. A Lewis gun could be mounted in several locations on the car, while another was positioned on top of the envelope. This was reached by a 30in (76cm)-diameter tube running through



One of the 14 'North Sea'-class non-rigid airships. *NARA*

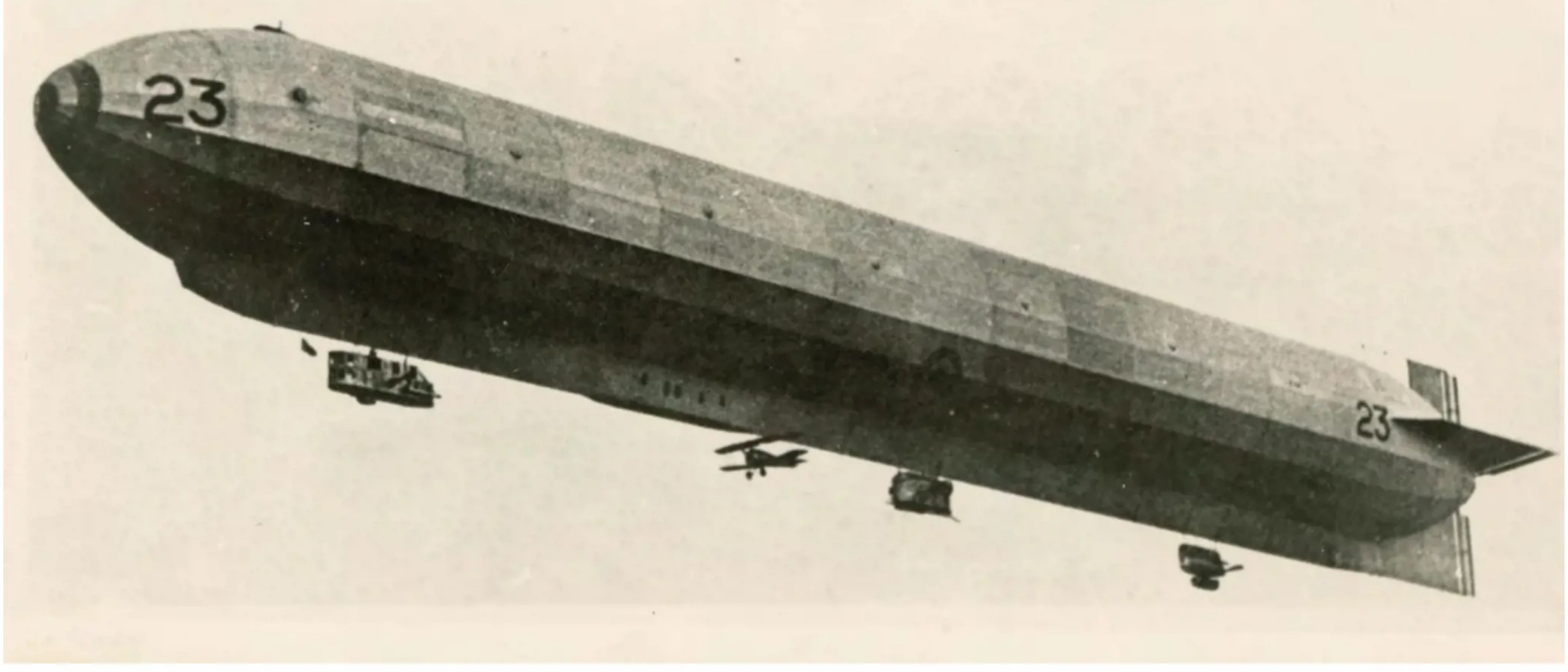
Built at Wormwood Scrubs, London,* SST.2 *was tested in July 1918

the centre of the airship. Initially this was little used, but after *C.17* disappeared in April 1917, thought to have been shot down by seaplanes, orders were given to man the upper gun whenever over the North Sea. An extra crewman was usually carried. *C.23* managed to shoot itself down when bullets from the upper gun pierced the envelope.

Of the 27 RNAS 'Coastals', 12 were crashed or wrecked; three were lost to enemy action and one was interned. *C.25* went missing on a patrol from Longside on 31 July 1918. While searching for a U-boat off Aberdeen, the airship probably found it and was shot down by its deck gun. Only a propeller was ever found. The U-boat never returned. While searching for *C.25*, *C.26* ran out of fuel and landed in neutral Holland, where the crew was interned.

The 'Coastal Star' class (*C*1-C*8*) had a new, longer envelope, a 110hp (82kW) Berliet engine pulling and the 220hp (164kW) Renault pusher sometimes replaced by a 240hp (179kW) Fiat engine.

Parachutes were fitted as standard. These



His Majesty's Airship* No. 23r *with a Sopwith Camel suspended beneath its envelope during experiments in November 1918

Sailors rush to catch the handling ropes of an 'SS'-class airship. These were powered and controlled from a surplus R.A.F. B.E.2 aircraft fuselage.

were rigged to the envelope and could be quickly attached to the crew's harnesses if needed. None of the class were lost in service, although *C*9* was damaged by a bomb exploding at its landing ground.

Non-rigid 'North Sea'-class airships were developed as a stop-gap before larger rigid ships could be completed. RNAS Kingsnorth built 14 (*NS-1-NS-13* and *NS-16*). The enclosed control cars could mount up to four machine-guns with another atop the envelope. Bomb load was up to six 230lb weapons. North Sea craft made pioneering flights to Norway, escorted the surrendering German fleet and conducted minesweeping experiments. Most were retired in 1919, but *NS-7* served until October 2021.

The RNAS built six 'SSP'-class ships from the spring of 1917. These mainly used the 100hp (76kW) Green engine. *SSP-3* was wrecked on its delivery flight, while *SSP-4* was lost in a snowstorm and *SSP-6* force-landed near Blackburn. The much-improved 'SSZ'-class used the 75hp (56kW) Rolls-Royce Hawk, specifically designed to power non-rigid airships. No fewer than 77 of the SSZs were built. *SSZ-1* detected U-boat *UB-103* and called in patrol boats which sank it. At least one other attacked a U-boat with machine-gun fire and others spotted mines that were then destroyed by armed trawlers.

The three 'SSE' and 14 'SST'-class non-rigid airships were slightly larger with two Hawk engines in pusher configuration.

Several rigid airships were under construction at war's end. They were still naval aircraft even though the RNAS had merged with the RFC, and they made a number of notable flights, including the first return air crossing of the Atlantic by *R.34* in July 1921. Unfortunately, the following month when *R.38* was being tested prior to sale to the U.S. Navy, it broke up in the air off Hull. All military airship development in Great Britain was immediately stopped. ■

Vickers R.29

Crew: 15-17
Length: 539ft (164.29m)
Diameter: 53ft (16.15m)
Capacity: 990,000 cu.ft (28,034m^3)
Useful lift: 17,000lb (7,700kg)
Powerplants: Four Rolls-Royce Eagle IV piston engines, each rated at 300hp (220kW)
Max speed: 57mph (92km/h)
Armament: Two machine-guns; four 112lb bombs or two 230lb bombs or depth charges

This No. 1 Squadron Nieuport 17 was forced down by enemy aircraft near Houthem, Belgium on 25 May 1917. Although it landed intact, pilot 2nd Lt J. R. Anthony died of wounds.

Nieuport Biplanes

French Fighting Scouts

Although they were not as numerous as other scouts used by the British services, the nimble Nieuports allowed pilots to engage in combat on an equal footing with the enemy, a rare trait for an Allied fighter in mid-1916.

The role played with the RFC and RNAS by the scout biplanes designed by Gustave Delage of the Société Anonyme des Etablissements Nieuport tends to be overlooked. Various models were operated by both services, all compact sesquiplanes powered by rotary engines.

The Nieuport 10 was a two seat scout, with distinctive V-shaped struts between the wings. The RNAS initially received 24 which entered service in May 1915, early examples going to No.1(N) Squadron at St Pol. Another 12 were delivered to the RNAS, while the Admiralty also became the only British operator of the single-seat Nieuport 11 Bébé scout, receiving 21, some of which served in the Aegean.

The Nieuport 12 was a development of the Type 10 with a larger top wing and revised position for the rear gunner. Around 120 built in Britain by William Beardmore & Co as well in France were delivered to the RNAS, of which 20 were transferred to the RFC in September 1916 to help make up its losses incurred during the Battle of the Somme. Although the Nieuport 12 had been heavily criticised by the Central Flying School, they were issued to No. 46 Squadron at Wyton, Cambridgeshire, which departed for the Western Front in October 1916. The squadron flew them at the front until April 1917, by when it had largely re-equipped with Nieuport 20s. A further 20 Beardmore-built Type 12s handed over to the RFC went to training units and squadrons working up prior to going to France.

The Nieuport 20 was a Type 12 with a Le Rhône 9J, rather than the Clerget 9Z, both engines having an output of 110hp. No. 1 Squadron had one on strength – possibly a prototype– by late June 1916, but the Flying Corps only received 21, re-equipping that unit and No.46 Squadron, while No.45 Squadron also had a few. They had been withdrawn from the frontline by the end of April 1917.

Although the RFC did not operate Nieuport 11s, it did have Type 16s, which featured a stronger airframe and more Le Rhône 9J in place of the 80hp 9C. It was the first Nieuport biplane to be delivered directly to the RFC, with the initial example arriving at the Aircraft Depot at St Omer in France on March 18, 1916. The scouts were issued in small numbers to several squadrons on the Western Front, although by October 1916 No. 60 Squadron had standardised on the model. They were withdrawn from frontline service in France during April 1917, but continued to be flown by the Scout School at St Omer that autumn.

The Nieuport 17 was a refinement of the Type 16 with greater wingspan and area to improve handling, the baseline variant retaining the Le Rhône 9J, while the 17bis having the 130hp Clerget 9B. The RNAS ordered 32 from Nieuport in France and another 50 from the Nieuport & General Aircraft Company in Britain, while the

Nieuport 12 A3270 was issued to No. 46 Squadron in January 1917 but was soon sent to a training school in England and was struck off charge in July. San Diego Air and Space Museum

RFC initially contracted for ten, which were delivered from July 1916. They were followed by another 50 (later increased to 60) by October 1916 and 50 in early 1917. In March and May 1917 the French handed over 60 and 100, the latter batch including some Type 23s. The Nieuport 23, of which about 80 were eventually received by the RFC, was a Type 17 powered by a 120hp Le Rhône 9Jb instead of the 110hp 9Ja. Nos 1, 29, 40 and 60 Squadrons operated both models on the Western Front, while Nos 14 and 113 Squadrons flew Type 17s in the Middle East.

Nieuports were flown by aces of many nations. The greatest exponent in the RFC was Captain Phillip Fletcher Fullard of No. 1 Squadron, who achieved 40 kills while flying Type 17s, 23s and 27s) between May and October 1917. Others included Albert Ball (32 on Type 16s and 17s), William A. 'Billy' Bishop (36 on Type 17s and 23s) and Edward C. 'Mick' Mannock (15 on Type 17s and 23s)

By late July 1917 the Nieuport 17 was outclassed as a fighter, although it remained in service, as the Type 24 failed to live up to expectations. While a good dogfighter, it lacked the speed of the latest fighters, while lateral control was considered to be poor. This problem was later traced to canvas fairing strips over the aileron hinge gaps; once removed, the ailerons became lighter and the Nieuport 24 was deemed fit for frontline service. The Nieuport 24bis was effectively a Nieuport 17bis re-engined with a Le Rhone 9Jb or 9Jby, while the definitive Type 24 had centre-section bracing and a faired tailskid. Ony around 23 were delivered, however, as the Type 24 was viewed as a stopgap until the similar Nieuport 27s became available. France initially allocated 100 (plus the equivalent of 30 as spares) to the RFC, for delivery in August and September 1917 but this was changed, first to Type 24bis, then a mix of 23s and 27s. A total of 71 Nieuport 27s were supplied, the first arriving at No.2 Aircraft Depot at Candas, France, on 14 August 1917. They were distributed to squadrons flying Nieuports on the Western Front, but were withdrawn to training units by the end of April 1918. ■

N3982 was a Nieuport 11 that served with No. 2(Naval) Squadron. It appears here to have a rudder from a different aircraft.

Nieuport 11

Crew: One
Length: 23ft 0in (7.00m)
Wingspan: 29ft 6in (9.00m)
Height: 8ft 10in (2.70m)
Empty weight: 705lb (320kg)
Max T/O weight: 1,058lb (480kg)
Powerplant: One Le Rhône 9C nine-cylinder rotary piston engine rated at 80hp (60kW)
Max speed: 104mph (167km/h)
Service ceiling: 14,765ft (4,500m)
Endurance: 2hr 30min
Armament: One 0.303in Lewis machine-gun, eight Le Prieur rockets

Pup B5259 'Monkey' of No. 56 Training Squadron at London Colney, 1917. This aircraft had a 110hp Le Rhône engine and a Lewis gun mounted above the top wing.

Sopwith Scout

The 'Pup'

Sopwith built a prototype scout at its own expense with the intention of countering the new German single-seaters reaching the front. In this it succeeded and paved the way for the Camel.

Legend has it that Harry Hawker chalked out the design that would become the Scout on the floor of the converted ice rink that served as Sopwith's Kingston-Upon-Thames factory.

As with many aircraft of the era, the exact first flight date or name of the pilot was not retained for posterity, but it is likely that Hawker himself flew the prototype between 9-31 February 1916 at Brooklands. Sopwith mainly contracted to the Navy, and naval pilots first tested the new scout. Their positive reports reached Lt Col Trenchard, head of the Military Wing in France and orders for the RFC soon followed. A problem was that there was no mechanism for the War Office to receive an 'Admiralty' aircraft, despite the urgent need for more RFC fighters to replace losses over the Somme. The solution was to establish new units, starting with No. 8 (Naval) Squadron in October. Within a month, this unit had scored 20 victories.

No. 54 Squadron was the first fully-equipped RFC squadron to go to France, in December 1916. No. 66 Squadron followed in March 1917 and No. 46 in April. By then, more Naval squadrons had formed, Nos. 3 and 9, the first Pups having been delivered to No. 1 Squadron RNAS in France the previous September.

The Pup was extremely simple in design. Essentially scaled-down from the Strutter configuration, it gained the nickname 'Pup', although this remained unofficial. Officially it became the Sopwith Type 9901 to the Navy and the Scout to the RFC. Most were powered by the 80hp (60kW) Le Rhône engine. Others were fitted with 80hp or 100hp (76kW) Gnome or Le Clerget motors. Normal armament was a Vickers gun mounted in front of the pilot and firing through the propeller arc with the help of Sopwith-Kauper synchronisation gear. Naval Pups had a Lewis gun that fired at an upwards angle through the wing cutout.

The company was extremely busy with Strutter production and three other firms were sub-contracted to manufacture the type: Beardmore, Standard Motor Co and Whitehead Aircraft.

At least 28 RFC and RNAS pilots achieved 'ace' status on the Pup. The highest-scoring were Maurice Guest, RFC (11) and John Malone, RNAS (ten).

With its light weight and high manoeuvrability, the Pup was a match for the Albatros single-seaters, despite having only one gun. Pups also destroyed two-seaters, balloons and five Gotha bombers. One pilot who flew Pups (unsuccessfully) against the German raiders was Lt James McCudden, who praised the little Sopwith's flying characteristics and especially its turning ability. He would go on to be one of the RFC's top aces, mainly on the S.E.5a.

The Pup proved suitable for night flying and three night training squadrons were established.

Of the 1,800 Pups built, only 216 were sent to France, some serving in Italy with No. 66 Squadron. The remainder were mainly used by training units in the UK or operated at sea.

The Pup played a major part in the development of naval aviation. Beardmore developed a version for shipboard use with folding wings and an undercarriage that could be retracted for stowage. The W.B.III also had unstaggered wings and flotation gear; about 60

Built as a two-seat Sopwith Dove, G-EBKY was converted to a single-seater in 1938 and has been with the Shuttleworth Collection ever since.

were built; but the modifications so reduced the performance that about half were used only for spare parts. Flying from a platform aboard the HMS Yarmouth, Flt Sub Lt Bernard Smart shot down the Zeppelin L 23 on 17 August 1917, being required to ditch in the sea for the lack of any way to land back on the cruiser.

The Pup is famous for making the first landing of a fixed-wing aircraft aboard a ship, when Squadron Commander Edwin Dunning landed on the converted battlecruiser HMS Furious on 2 August 1917. Sadly, Dunning was killed five days later when his wheeled Pup rolled off the deck during his third landing attempt. In 1918 Pups with skid undercarriages were embarked on Furious, which now had both launching and recovery decks. They were used for anti-Zeppelin patrols before being replaced by Camels. ■

Sopwith Pup

Crew: One
Length: 19ft 4in (5.89m)
Wingspan: 26ft 6in (8.08m)
Height: 9ft 5in (2.87m)
Empty weight: 787lb (357kg)
Max T/O weight: 1,225lb (556kg)
Powerplant: One Le Rhône 9C nine-cylinder rotary piston engine rated at 80hp (60kW)
Max speed: 111mph (179kW)
Service ceiling: 17,500ft (5,334m)
Endurance: 3hr
Armament: One 0.303in Lewis machine-gun

Clerget-engined Pup C256 'Baby D' was used for intermediate training by No. 42 Training Depot Station at Hounslow in 1918. NASM

A pilot supervises the loading of 20lb bombs on an F.K.8 before a mission over enemy lines. The aircraft serials have been obscured by the wartime censor.

Armstrong Whitworth F.K.8

The 'Big Ack'

Little-remembered today, the F.K.8 was a general-purpose aircraft well-liked by its crews for its reliability and ability to take battle damage.

Designed for Armstrong, Whitworth and Co by Dutchman Frederick Koolhoven, the F.K.7 was intended for the same roles as the R.E.8, which was on order at the same time as the prototype F.K.7 (A411) was being tested by the Central Flying School in June 1916. To hedge their bets, the War Office quickly placed an order for 50 F.K.7s.

Evaluation of A411 in France in September was positive. Although production aircraft were essentially the same, they were designated F.K.8s and were first issued to No. 35 Squadron, which moved to France in late January 1917. Operational use showed a few deficiencies, such as an undercarriage that was unsuitable on rough airfields, and radiators that became clogged. The Armstrong Whitworth interruptor gear was unreliable and replaced with Constantinescu gear.

The F.K.8 was a conventional two-bay biplane with staggered wings that had ailerons on all surfaces. The Beardmore engine installation included large radiators on the forward fuselage sides and tall exhaust manifolds. These protuberances, combined with the complicated undercarriage, caused drag, limiting the maximum speed to 8mph (13km/h) lower than that of the R.E.8's.

The F.K.8's manufacturer, unlike some others, was willing to address these issues. Later production aircraft had much smaller radiators and a long exhaust pipe running beside the cockpit, reducing drag and improving the view. The cowling was made slightly more streamlined and many aircraft in France had their triple V-strut undercarriages replaced by Bristol F.2 units, until they ran out. The solution was a simpler design, introduced on the production lines. Deliveries of F.K.8s amounted to an estimated 1,652 examples, 650 of which were built by Armstrong Whitworth, 600 by Angus Sanderson & Co in Newcastle and the rest by a variety of smaller manufacturers. Many were supplied to France.

Although relatively obscure today, the F.K.8 was flown by two Victoria Cross recipients. Despite several bullet wounds inflicted by Fokker Dr.Is, Lt Alan McLeod of No. 2 Squadron climbed onto the wing of his burning F.K.8, reaching into the cockpit to side-slip it to a crash-landing. His observer, Lt Arthur Hammond was also wounded, but shot down three of the triplanes. Both survived, Hammond becoming the only F.K.8 ace and receiving a bar to his Military Cross while McLeod was awarded the VC.

Capt. Ferdinand West and Lt William Haslam of No. 8 Squadron were attacked by six enemy fighters while returning from a bombing mission on 10 August 1918. Despite severe injuries to his legs, West brought the aircraft down behind British lines and refused medical aid until he had passed his report to the local commander.

Although most were scrapped soon after the Armistice, a few F.K.8s remained in service with the RAF in Greece until September 1919. ■

Armstrong Whitworth F.K.8

Crew: Two
Length: 32ft 0in (9.50m)
Wingspan: 43ft 8in (13.30m)
Height: 10ft 10in (3.30m)
Empty weight: 1,918lb (870kg)
Max T/O weight: 2,811lb (1,275kg)
Powerplant: One Beardmore straight-six piston engine rated at 160hp (119kW)
Max speed: 98mph (158km/h)
Service ceiling: 13,000ft (3,962m)
Endurance: 3hrs
Armament: One Vickers and one Lewis 0.303in machine-gun; up to 160lb (73 kg) of bombs

Spad 7 A8794 served with No. 19 Squadron until it was "shot through" on 27 July 1917. The Spads were criticised for poor forward visibility and placement of the radiator above the top wing where damage could result in the pilot being scalded.

Spad 7 and 13
French Fighters

Nearly 14,000 Spad 7s and 13s were built in France and although substantial numbers were purchased for the RFC, they had a mixed reputation and relatively brief operational careers.

The pioneering but struggling Deperdussin firm (Société pour les Appareils Deperdussin) was taken over by Louis Blériot in 1914 and renamed Société pour l'Aviation et ses Dérives, retaining the acronym SPAD. The appearance in early 1915 of a new 140hp (104kW) Hispano-Suiza V-8 motor offered great promise, demonstrating a high power-to-weight ratio for a water-cooled engine. SPAD's Chief engineer Louis Béchereau designed a compact fighter around it. Production aircraft had the H-S 8Aa engine of 150hp (112kW) or the 180hp (134kW) 8Ab. And were armed with a single synchronised Vickers gun.

The prototype took its first flight in July 1916 and was immediately ordered into production. Deliveries of the Spa.7.C1 (usually styled Spad 7 or S.VII) to the French Air Service began on 2 September and very shortly thereafter to the RFC, with 30 ordered from French factories. With French production lines stretched, British Nieuport and Mann, Edgerton and Co. of Norwich were contracted to build 125 S.VIIs, The RFC was desperate for fighters and agreed with the RNAS in December 1916 to swap all the latter's Spads for the Sopwith Triplanes it had ordered. In the end, 120 S.VIIs were delivered by Mann, Edgerton and 120 from British Blériot, partly because they were regarded as inferior to French-built Spads. Only a few served in France.

Deliveries to No. 19 Squadron began in October and to No. 23 in February 1917, although at a slow rate. Extra orders for 120 were made from French company Kellner et Fils and 30 more were supplied from French stocks.

The highest-scoring Spad pilot of any nation was William Kennedy-Cochran-Patrick of No. 23 Squadron RFC, who downed 18 aircraft, mostly Albatros D.IIIs and D.Vs. Canadian Douglas McGregor with the same unit accounted for 12. The S.VII was phased out from the Western Front in late 1917. Most of the aircraft were sent to Mesopotamia and Palestine or issued to training units. Several S.VIIs were sold to the USA and used for advanced training in California, retaining their British markings and serials.

One Spad XII was tested in the UK at Martlesham Heath. This variant had a 37mm Puteaux cannon firing through the propeller shaft, and although several French aces had success with this combination, the RFC declined to adopt it.

The S.VII's successor was the S.XIII, which was very similar in appearance, but had a 200hp (149kW) H-S 8b engine with the propeller turning the opposite way (to the left). The Spad 13 was slightly larger than the 7 with a curved trailing edge to the rudder, rounded wingtips and twin Vickers guns. The RFC's contracts with Kellner were amended to change 60 S.VIIs to XIIIs and to order 100 more, but in the end many fewer were delivered. Only No. 23 Squadron would be fully equipped with the XIII, flying the type in combat for just four months and there were no British aces, although the type would prove to be successful with the US Army Air Service, flown by their most famous pilots. ■

SPAD S.XIII

Crew: One
Length: 20ft 6in (6.25m)
Wingspan: 27ft 1in (8.25m)
Height: 8ft 7in (2.60m)
Empty weight: 1,326lb (601kg)
Max T/O weight: 1,888lb (856kg)
Powerplant: One Hispano-Suiza 8Ba V8 piston engine rated at 200hp (149W)
Max speed: 135mph (218km/h)
Service ceiling: 21,820ft (6,650m)
Endurance: 1hr 40m
Armament: Two 0.303in Vickers machine-guns

N5420 was supplied as a pattern aircraft to sub-contractor Clayton & Shuttleworth. It was later issued to the RNAS in France but wrecked in an accident in December 1917.

Sopwith Triplane

The 'Tripehound'

Despite its brief career, the Triplane was very successful and influential, showing the value of manouevreability and the effectiveness of a twin-gun armament in air combat.

Like the Pup, the Triplane came about as the result of a naval requirement, and again the designer was Herbert Smith. The triplane layout gave the widest possible field of vision for the pilot. Three wings allowed a narrower chord in turn permitted a shorter fuselage, basically that of the Pup, as was the tailplane. The wingspan was the same as the Pup's and distributing the wing area over three sets of wings with ailerons on each kept the span short and gave an excellent roll rate.

The Triplane's armament was a single Vickers gun synchronised to fire through the propeller,

Replica Triplane G-BWRA is marked as the prototype, N500. Completed in 2018, it flew with the Great War Display Team.

Triplanes of No. 1 (Naval) Squadron at Bailleul, France in 1917. N5454, nearest the camera was used by Richard Minifie to score ten of his 21 wartime victories.

although a small batch of aircraft built by Clayton & Shuttleworth had twin guns.

the Triplane prototype was built in just three months, flying in May 1916, and was dispatched to the front for evaluation in August, flying a combat mission within an hour of arrival. At least two victories were scored in the prototype, a feat that may be unique in the annals of fighter aviation. By December 1916 the first unit, No. 1 Squadron RNAS was fully equipped with Triplanes. This was one of four naval squadrons attached to the Royal Flying Corps.

The RFC also ordered triplanes, but they were destined not to see action. In a deal to alleviate the RFC fighter crisis, the RNAS swapped all its Spads for the 266 Triplanes on order for the RFC, but only 150 were actually completed by Sopwith, Oakley Ltd and Clayton & Shuttleworth.

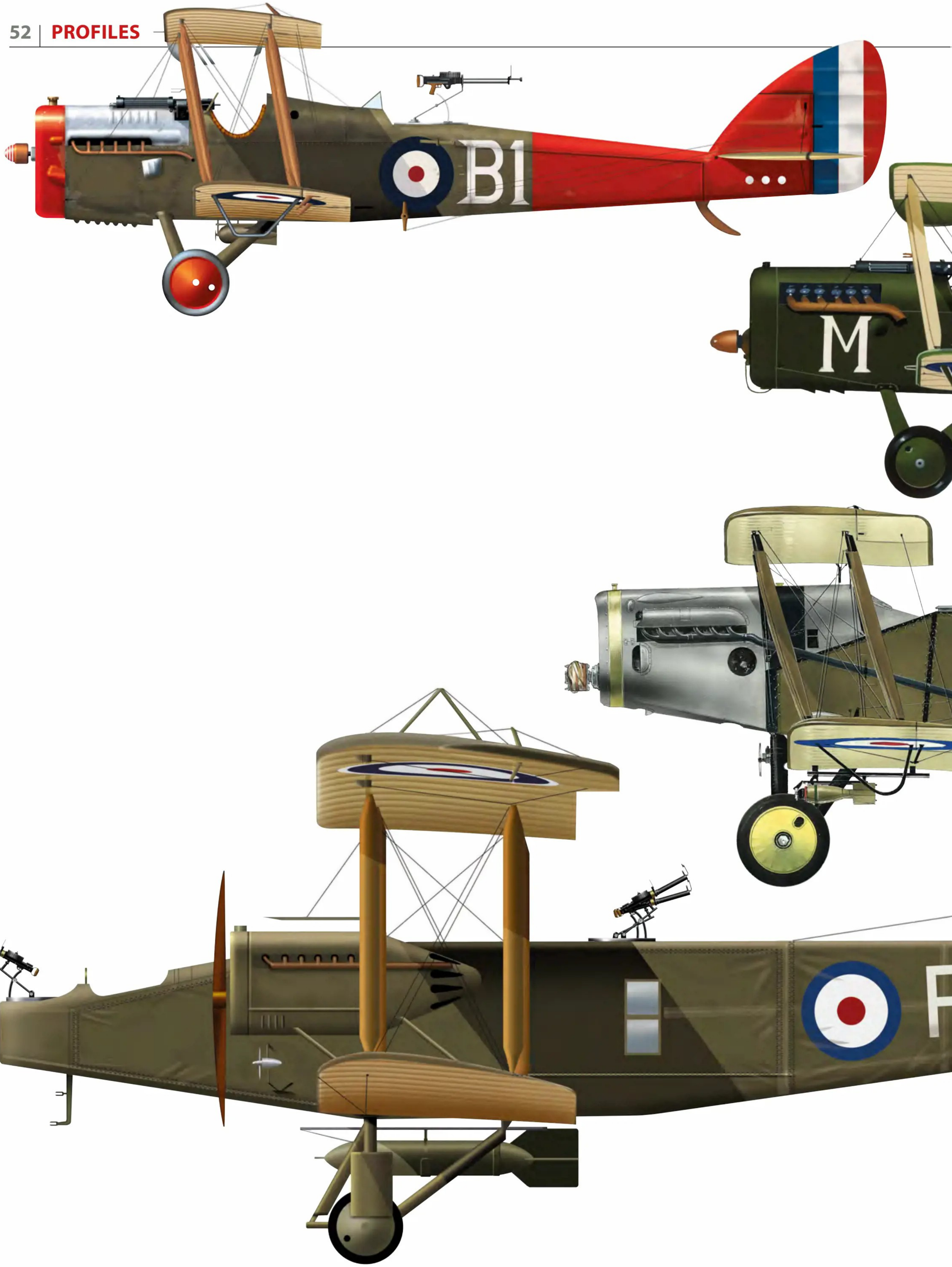
Undoubtedly the most famous Triplane pilot was Flt Sub Lt Raymond Collishaw of No. 10(N) Squadron. Leading 'Black Flight', comprised of fellow Canadians, Collishaw shot down 16 German aircraft, mostly single-seaters, in June 1917 alone and would achieve a total of 59 kills, 29 on Triplanes. The five pilots of flight accounted for 87 German aircraft in May-July 1917 for the loss of only one of their own.

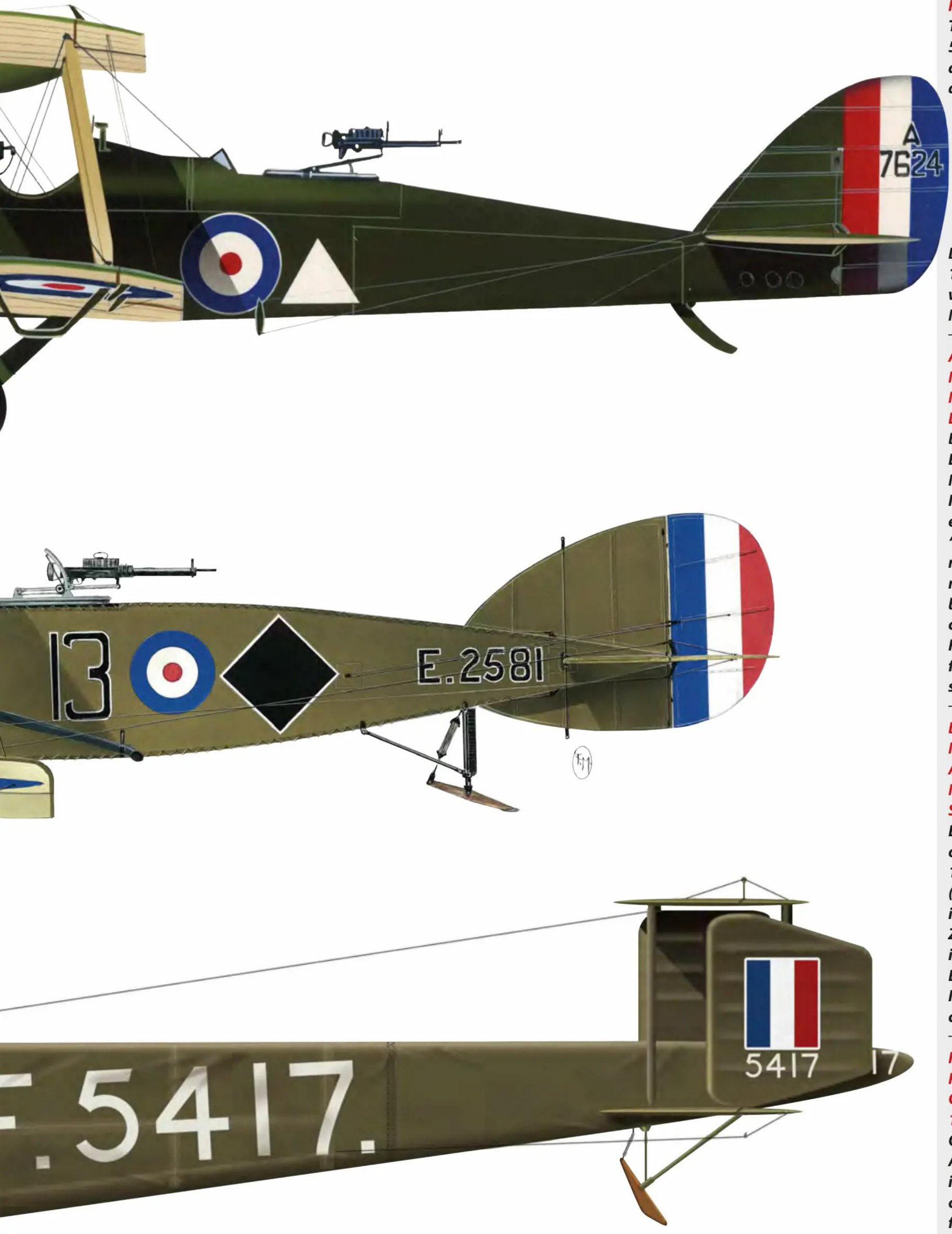
Although it inspired a 'triplane frenzy' with similar designs appearing from a number of British and German manufacturers, the Sopwith Triplane's frontline career was a brief one. Their last major action was the Third Battle of Ypres and they were replaced on the frontline by Camels from November 1917.

Given its kill-to-loss ratio, the Triplane must be considered one the best value for money fighter aircraft ever produced. ■

Sopwith Triplane

Crew: One
Length: 19ft 6in (5.94m)
Wingspan: 26ft 6in (8.08m)
Height: 10ft 6in (3.20m)
Empty weight: 993lb (450kg)
Max T/O weight: 1.415lb (642kg)
Powerplant: One Clerget 9B nine-cylinder rotary piston engine rated at 130hp (97kW)
Max speed: 116mph (187kW)
Service ceiling: 20,000ft (6,096kW)
Endurance: 2hr 45min
Armament: One 0.303in Vickers machine-gun


B1
M



Airco D.H.4 N6000
No. 5 (Naval) Squadron, Royal Naval Air Service
Petite Synthe, Belgium
February 1918

This Westland-built DH.4 was issued to 5(N) Squadron in mid-1917. Despite being a bomber its crews sent several enemy aircraft down out of control. In February 1918 14 victory ace Flt Lt Euan Dickson and observer Walter Naylor knocked down two Albatros D.Vs. In March Flt Cdr Charles Bartlett and Naylor claimed a Fokker Dr.1 and an Albatros D.V. For his second and fifth (of five) victories, Flt Lt Charles Lupton claimed a D.V in December 1917 and a Pfalz D.III in April 1918 –- both with observer Wood – by which time the unit had been renumbered No. 205 Squadron RAF.

Airco DH.4 A7624
No. 55 Squadron, Royal Flying Corps
Nancy, France
Late 1917

Built by the parent company with an Eagle V engine, A7624 was received by No. 55 Squadron on 15 September 1917. It had a radio transmitter fitted by the end of that month and was allocated to 'B' Flight. In conditions of thick ground mist on 14 November, A7624 set off to make a bombing raid against Dillengen, but stalled and crashed on take-off. The crew of 2nd Lts Arthur S. White and Arthur F. Castle suffered minor injuries, but the fuselage broke in half and the aircraft was struck off on 23 November.

Bristol F.2b Fighter E2581
No. 39 (Home Defence) Squadron, Royal Air Force
North Weald, Essex
September 1918

E2581 was built by Bristol at Filton as part of a batch of 500 F.2bs ordered in early 1918 for the RAF. It served with No. 39 (Home Defence) Squadron at North Weald in the last months the war, flying anti-Zeppelin patrols. Selected for preservation, it joined the Imperial War Museum in 1923. Ever since it has been on display at the IWM's sites at Lambeth or Duxford and is currently at the latter location.

Handley Page O/400 F5417
RAF Independent Force
Cricklewood, London
1918

O/400 C/n HP-14 was built at National Aircraft Factory 1 at Waddon, Surrey in 1918. Although details of its military career are unknown, it was one of the first four of 16 O/400s converted for civilian use for Handley Page Transport for newspaper delivery and passenger carriage with 12 seats. Redelivered as G-EAAW 'Flamingo' in April 1919, It was operated on the London-Brussels thrice-weekly air service from September. It was withdrawn in April 1920 and later scrapped at Cricklewood.

Reproduction R.E.8 ZK-REX wears the markings of an aircraft of No. 52 Squadron, which went missing in February 1918, the crew being made prisoner. *David Evans*

Royal Aircraft Factory R.E.8

'Harry Tate'

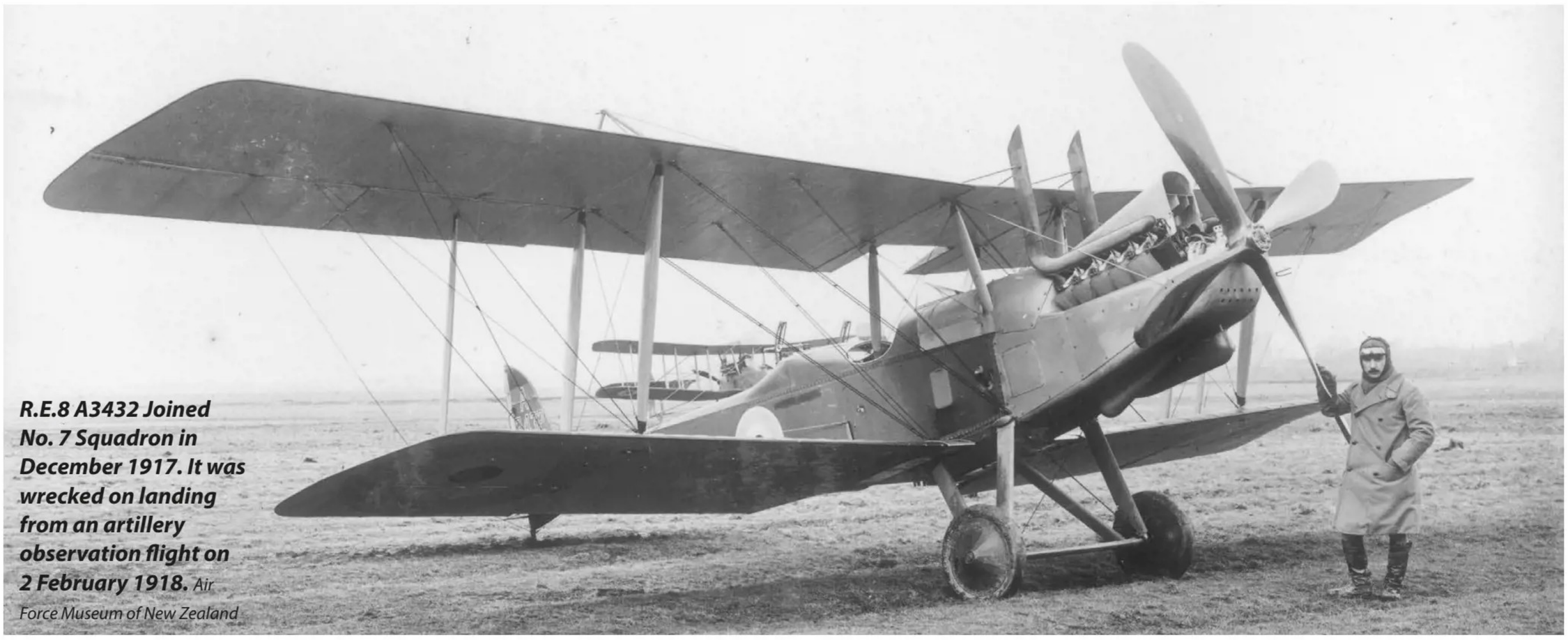
A stately and stable observation and photoreconnaissance platform, the R.A.F. R.E.8 was designed to replace the slow and vulnerable B.E.2 with an aircraft of superior performance and armament.

Neither of these ambitions were a stretch, and the actual improvements were marginal, but at least the observer was now located in the seat with a view. Designed by John Kenworthy of the Royal Aircraft Factory, the first of two R.E.8 ('Reconnaissance Experimental') prototypes (7996) flew on 17 June 1916. The second was sent for evaluation in France in July where aircrew suggested many modifications, including an enlarged rudder. Large orders had already been made and the first production aircraft had the same small rudder as the prototypes and a rear gun mounting where the observer could not turn around in his seat or fire from a standing position, so he had to somehow aim and fire it over his shoulder or kneel facing backwards.

The RE.8 had a forward-firing machine-gun mounted on the fuselage side at an angle so the pilot could fire it, but where the bullets would miss the propeller. This made hitting an opponent almost impossible and was later replaced by gun firing through the propeller arc using a Continescu interruptor gear, although other methods were tried or suggested including deflector plates and a Hispano engine with the gun centrally mounted.

The first squadron to fly the R.E.8 operationally was No. 52 Squadron, which arrived in France in November 1916. Using early production aircraft, this newly formed unit suffered many accidents, particularly spins, and handed over its R.E.8s to the more experienced No. 34 Squadron in early 1917, accepting the latter's B.E.2es in exchange. They had more success with the type, especially as newer examples with larger fins arrived, but in general the R.E.8 was regarded as having heavy ailerons but a sensitive rudder. The tendency to spin was reduced by fitting a ventral fin at the base of the tail, particularly by training units. This further reduced what little agility the RE.8 had.

The RE.8 rarely achieved anything like its stated top speed. The difference between the actual combat speed and the stalling speed was only about 20mph (32km/h). Acceleration was poor and the observer was instructed to sit as low as possible during take-off to reduce wind resistance. The high stalling speed also made landings difficult and dangerous. More squadrons were soon equipped with the 'Harry Tate', nicknamed after a popular music



R.E.8 A3432 Joined No. 7 Squadron in December 1917. It was wrecked on landing from an artillery observation flight on 2 February 1918. *Air Force Museum of New Zealand*

hall comedian, but aircrews found flying the RE.8 anything but amusing. RE.8s fell in great numbers to German fighters. Manfred Von Richthofen, the 'Red Baron', shot down seven of them, but didn't regard them as much sport.

Before too long an improved rear position with a Scarff gun mount was introduced and so-equipped, the R.E.8 could much better defend itself. Lt Hervey Rhodes of No. 12 Squadron scored 11 victories as an R.E.8 observer, flying with two pilots (Lts Croye Pithey and Noel Garland). Rhodes shot down two observation balloons, three Pfalz D.IIIs, two Fokker D.VIIs, a DFW C.V and two LVG two-seaters in May-September 1917.

Despite their pedestrian performance and vulnerability 4,077 R.E.8s were produced by the Royal Aircraft Factory, Austin Motors, Standard Motors, Siddeley-Deasy and Coventry Ordnance Works. A further 353 on order were cancelled at the end of the war.

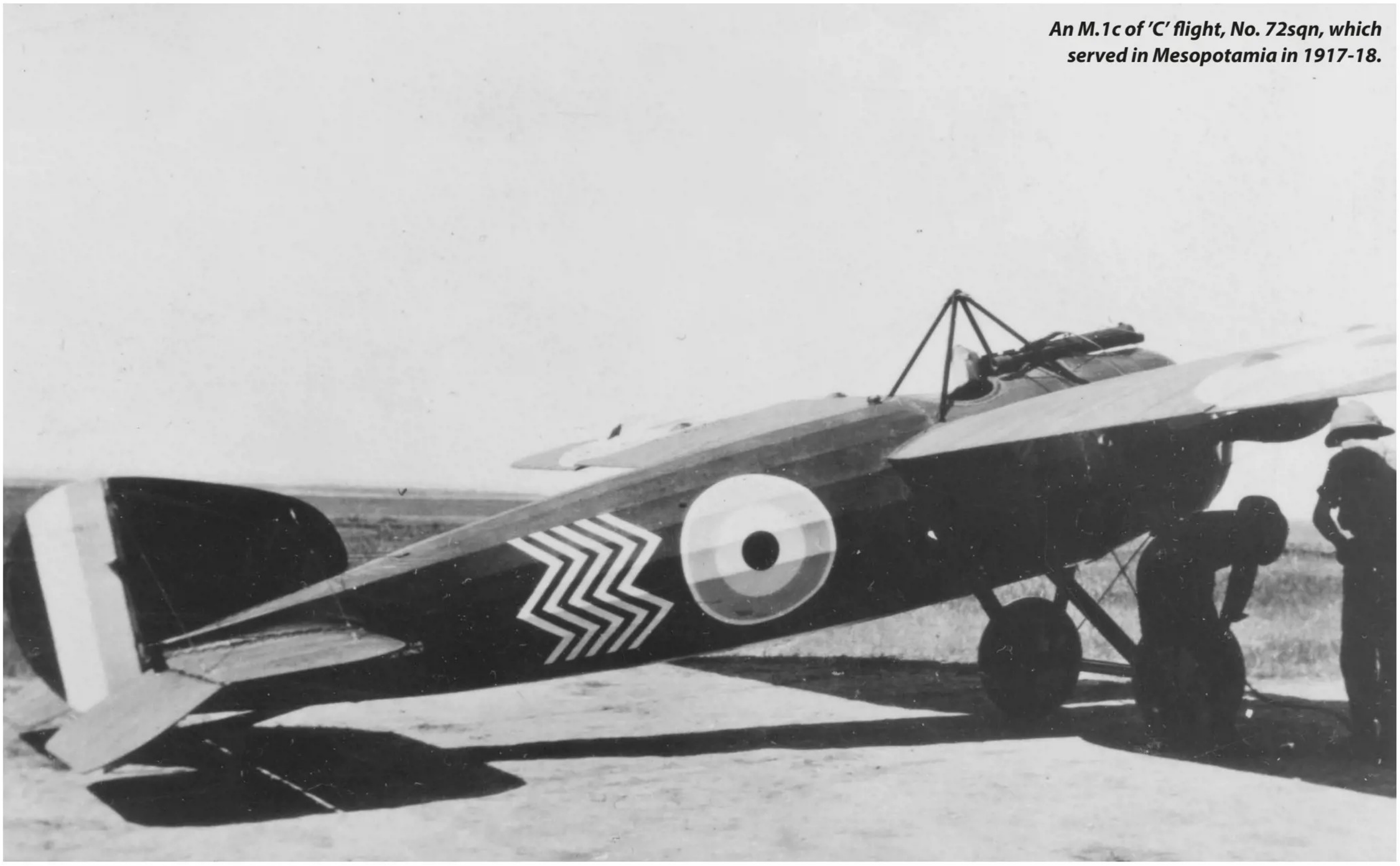
The type saw action on the Western Front on reconnaissance, artillery spotting and bombing duties and was also used in Italy, Palestine and Mesopotamia. Some were still in France at war's end and R.E.8s persisted in the Middle East for some time afterwards. The Belgian Air Force also adopted the R.E.8, flying 22 with the 180hp (134kW) Hispano Suiza liquid cooled V8 engine from July 1917 until the war's end. ■

R.A.F. R.E.8

Crew: Two
Length: 27ft 11in (8.50m)
Wingspan: 42ft 7in (12.98m)
Height: 11ft 5in (3.47m)
Empty weight: 1,803lb (
Max T/O weight: 2,678lb (1,215kg)
Powerplant: One Royal Aircraft Factory 4a inline piston engine rated at 150hp (112kW)
Max speed: 103mph (166km/h)
Service ceiling: 11,000ft (3,353m)
Endurance: 4hrs
Armament: One 0.303in Vickers machine-gun and one or two 0.303in Lewis machine-guns; up to 260lb (118kg) of bombs

Austin Motors-built R.E.8 A3229 served with No. 21 Squadron until 31 July 1917 when enemy bullets set its Very flare box alight and it force-landed. The crew survived.

Jim Winchester collection



An M.1c of 'C' flight, No. 72sqn, which served in Mesopotamia in 1917-18.

Bristol M.1

'The Bullet'

Although monoplanes had been cleared for service by a War Office committee in 1913, prejudices lingered, following a series of structural failures. The M.1 proved the doubters wrong.

By 1916 the RFC in France was crying out for fighting aircraft with better performance. Bristol's Frank Barnwell knew that biplane speed was restricted by drag and, drawing on experience with the Scout, designed a monoplane with the lowest drag possible. The M.1 had a circular-section fuselage and a high-set wing with elliptical tips. The large spinner faired into the engine cowl and gave rise to the 'Bullet' nickname that was commonly applied to the M.1

The M.1a prototype, A5138, first flew at Filton on 14 July 1916. Tests proved it had excellent manoeuverability and climb rate. The only criticism by the War Office test pilots was that the visibility forwards and downwards was poor. Prejudice against monoplanes lingered, however, and only reluctantly was an order made – for four M.1Bs. This pre-production version had revised cabane strutting and was armed with a Vickers machine-gun on the left wing root. A cut-out in the starboard root gave some downward visibility. The first two had the same engine as the prototype, but the subsequent pair had 130hp (97kW) Clerget and 150hp (112kW) Bentley BR.1 engines. Trials with the M.1b were successful, but it was not until August 1917 that a contract was placed for a production version. The M.1c was powered by a 110hp Le Rhône and had its gun centrally mounted, firing through the propeller with a Sopwith-Kauper interruptor gear.

The Monoplane was rejected for service on the Western Front on the questionable grounds that its landing speed of 49mph (80km/h) was too fast for the small French airfields. Instead the M.1c was issued to units in the Balkans and Middle East. None of those were fully-equipped with the type and it is thought that only 33 examples served overseas. Monoplane flights of Nos. 17 and 47 Squadrons operated from Salonika in Macedonia against Turkish and Bulgarian forces before they were merged into No. 150 Squadron. Capt. Fredrick Travers of this unit shot down five of his nine victims in the M.1c, all in September 1918, becoming the only Bullet ace. Four of 150's M.1s were supplied to No. 63 Squadron and No. 111 also flew the type in Palestine. The remainder were issued to flying schools where they were prized by instructors as personal mounts; many wore colourful individual schemes. ■

Bristol M.1c Monoplane

Crew: One
Length: 20ft 6in (6.24m)
Wingspan: 30ft 9in (9.37m)
Height: 7ft 9in (2.37m)
Empty weight: 902lb (409kg)
Max T/O weight: 1,347lb (611kg)
Powerplant: One 110hp (82kW) Le Rhône 9J rotary engine rated at 110hp (82kW)
Max speed: 130mph (209km/h)
Service ceiling: 20,000ft (6,096m)
Range: 217 miles (350km)
Armament: one forward firing 0.303in Vickers machine-gun

D.H.4 replica ZK-DHA flies in New Zealand in the colours of the USAAS' 50th Aero Squadron and is powered by an original Liberty engine. *David Evans*

Airco DH.4 and DH.4A

The 'Flaming Coffin'

As well as fighter and bomber missions, the D.H.4 was used for artillery spotting and photoreconnaissance and is regarded as one of the most versatile aircraft of World War One. It had a perhaps undeserved reputation for catching fire.

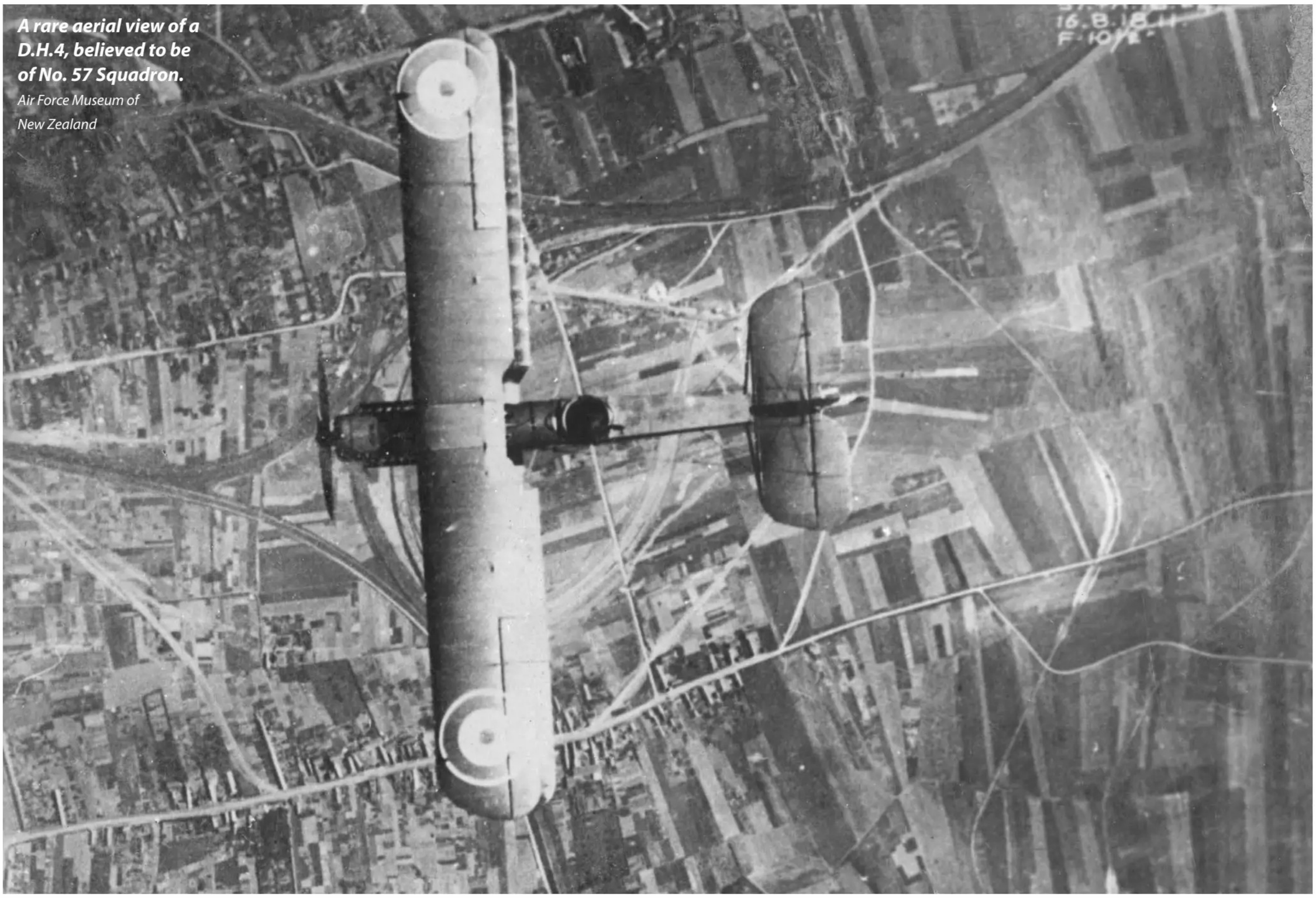
Designed by Geoffrey de Havilland and A. E. Hagg, the Airco D.H.4 was the first purpose-built light day bomber. It was a fairly conventional biplane with a two-bay wing that had slight dihedral on each surface. The pilot's cockpit was positioned between the wings, while the observer sat behind with a clear view.

De Havilland himself made the first flight in his creation at Hendon in August 1916. The first aircraft used the 200hp (153kW) Beardmore-Halford-Pullinger (B.H.P.) six-cylinder inline engine, but delays with this saw the second prototype and initial production models appear with the Rolls-Royce Eagle of 250hp (187kW). This resulted in a longer nose than the design had originally called for and the characteristic flat front profile.

The RFC originally saw the D.H.4 as a reconnaissance fighter with a capability to carry bombs as necessary, but soon realised its potential as a bomber and made plans for its introduction even before official testing began in late 1916. By this time, contracts for 740 had been placed, some with Eagle engines, others with the R.A.F.3a or B.H.P. This put an enormous strain on engine supply, particularly of the left-handed Eagle, but deliveries of D.H.4s began to No. 55 Squadron in January 1917, initially only equipped for fighter-reconnaissance duties.

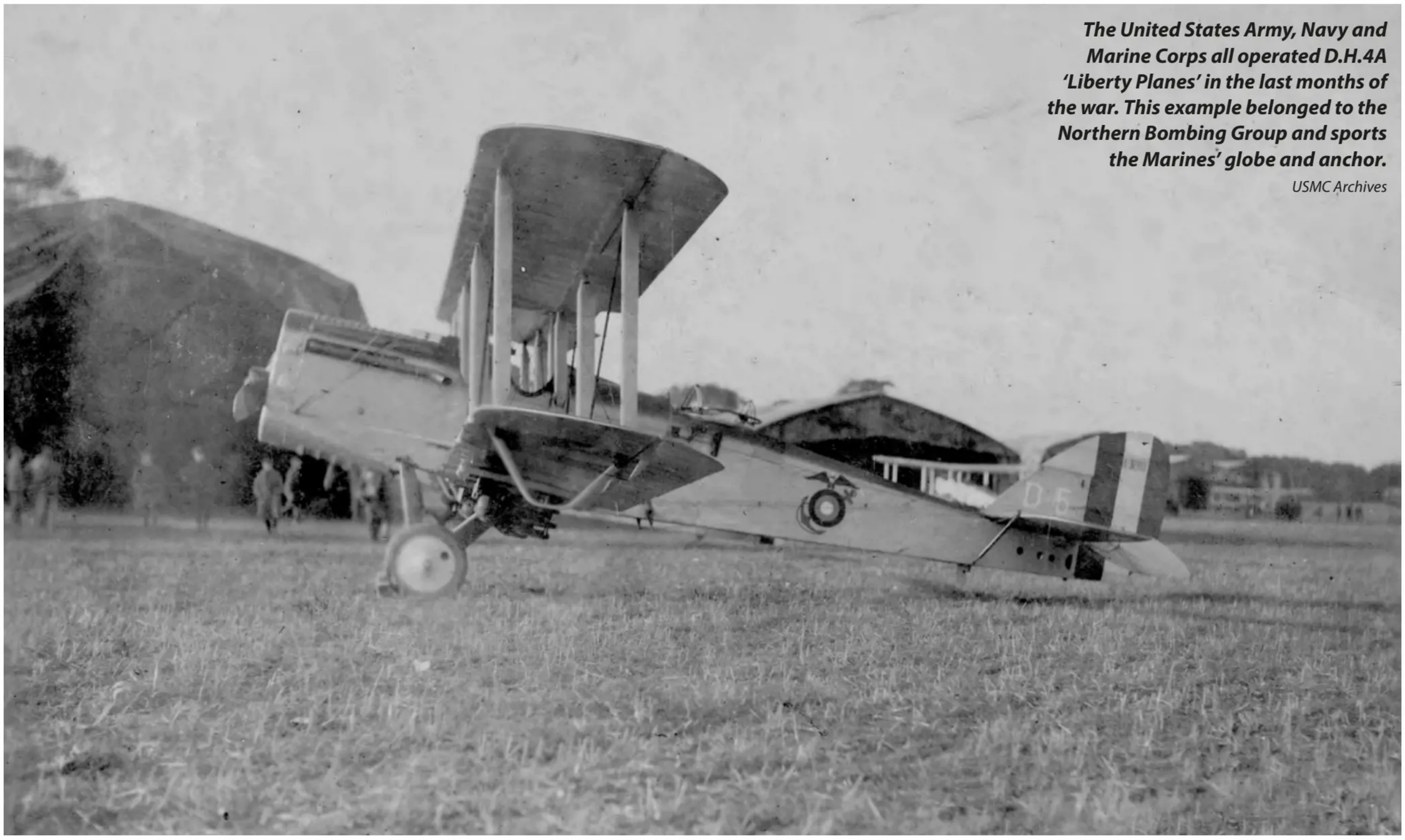
Modifications later allowed any model of Eagle engine to be fitted. Those marks with higher output required a larger propeller and a longer undercarriage, which later became

D.H.4 A7624 was issued to No. 55 Squadron in mid-September 1917. Its career was short as it crashed on take-off on 14 November.



A rare aerial view of a D.H.4, believed to be of No. 57 Squadron.
Air Force Museum of New Zealand

No. 18 Squadron flew the D.H.4 in France from June 1917 until October 1918 before transitioning to the D.H.9A



The United States Army, Navy and Marine Corps all operated D.H.4A 'Liberty Planes' in the last months of the war. This example belonged to the Northern Bombing Group and sports the Marines' globe and anchor.

USMC Archives

standard. The B.H.P. engine (originally the Galloway Adriatic) in turn became the Siddely Puma, which was fitted to relatively few D.H.4s. The Fiat A.12 was installed on 40 D.H.4s that were supplied to Imperial Russia.

Most D.H.4s had the reliable Eagle that allowed them to climb above the effective altitude of enemy fighters. For the time it was fast and considered easy to fly. However, due to the vulnerable location of the petrol tank between the crew member, the D.H.4 acquired the nickname 'flaming coffin'. A criticism was that the pilot was also seated too far from the observer/gunner for effective communication.

Three aviators achieved similar scores on the D.H.4. Euan Dickson of the RNAS achieved 14 victories while flying D.H.4s with No. 5 (Naval) Squadron (No. 205 Squadron RFC after April 1918). Gunner Walter Naylor was also credited with 14 kills, two of them while flying as Dickson's observer. David Stewart downed 16 enemy aircraft, two as an observer on F.E.2s and 14 flying D.H.4s of No. 18 Squadron.

In 1918 DH.4 Squadrons formed part of the Independent Force, a strategic branch of the RAF dedicated to attacking targets in Germany, alongside Handley Page O/400s and other large bombers. A total of 1,429 DH.4s were built in the UK. Many were modified for commercial use after the war, some as airliners.

Three manufacturers in the USA built nearly 5,000 DH.4As, also known as the Liberty Plane, powered by the 400hp (298kW) Liberty engine. Dayton-Wright alone built 3,100, the Fisher Body Division of General Motors produced 1,600 aircraft, and the Standard Aircraft Corporation built 140. Orders for an additional 7,502 were cancelled after the Armistice.

More than 1,200 U.S.-built D.H.4s were shipped to Europe, the only American-built aircraft to see combat (from August 1918) on the Western Front. Dayton-Wright-built D.H.4s also saw US Naval Air Service (USNAS) use in Belgium with combined US Navy and Marine Corps units. Four American aviators received the Medal of Honor for actions in D.H.4s. Lt Harold Goettler and 2nd Lt Erwin Bleckley of the 50th Aero Squadron flew numerous missions over enemy lines to drop food and ammunition to a cut-off U.S. battalion before their aircraft was shot down. Marines 2nd Lt Ralf Talbot and Gunnery Sgt. Robert Robinson fought off repeated attacks by German aircraft to complete their mission and return, despite serious wounds to the observer.

'Liberty Planes' were armed with forward-firing 0.30-caliber Marlin machine- guns as well as Lewis guns in the rear cockpit. The plywood-skinned D.H.4B was in US production at war's end, incorporating many improvements first introduced on the D.H.9A such as the relocated fuel tank and pilot's cockpit positions. Boeing rebuilt many as the D.H.4M (modernised) with welded tube frames. Those redelivered to the US Navy in 1922–25 were OB-1s and O2B-1s with fabric covering. Some Marine Corps D.H.4s were used in action in Nicaragua in 1929. The US Army's D.H.4s were used for a myriad of tasks including photography, border patrol, air ambulance and airmail delivery. The very first US aerial refuelling trials were carried out by D/H.4Bs in October 1923. The last US Army D.H.4s were retired in 1932. Other countries to use the DH.4 (mostly British-built examples) included Australia, Canada, Greece, Japan, New Zealand, South Africa and Spain. D.H.4Bs went to a number of South American nations. ■

Airco D.H.4

Crew: Two
Length: 30ft 8in (9.35m)
Wingspan: 42ft 5in (12.92m)
Height: 11ft 0in (3.35m)
Empty weight: 2,387lb (1,083kg)
Max T/O weight: 3,472lb (1,575kg)
Powerplant: One Rolls-Royce Eagle VII V-12 piston engine rated at 375hp (275kW)
Max speed: 143mph (230km/h)
Service ceiling: 23,500ft (7,163m)
Endurance: 6hr 45min
Armament: Two or four 0.303in machine-guns; 460lb (209kg) of bombs

The extreme back-stagger of the D.H.5's top wing is well illustrated on this Le Rhône-engined example.

Airco D.H.5

Staggered

Described as "possibly the least successful aeroplane designed by de Havilland during the war", the unconventional-looking D.H.5 was designed to give the pilot the best possible view.

The pusher-configuration D.H.2 gave the pilot an excellent view and field of fire, which Geoffrey de Havilland tried to recreate by designing the tractor-engined D.H.5 with 27 degrees of back-stagger. This put the pilot's head in line with the leading edge of the upper wing with no view above or behind him. The development of the Contstantinesco interrupter gear allowed a Vickers gun to be fired through the propeller arc and be in easy reach for clearing stoppages.

Prototype A5172 flew in October 1916 and contracts for an eventual 550 D.H.5s were issued to Airco, Darracq Motor Engineering Co, British Caudron and Marsh, Jones & Cribb. Engines were the 110hp (82kW) Le Rhône or Clerget. Deliveries of the interrutper gear units were delayed and this had a knock-on effect on production. Series aircraft from the prototype differed in having a fuselage of circular cross-section and an auxiliary fuel tank mounted above the wing. A requirement for the gun to be trainable up to 45 degrees above the horizontal was dropped.

Deliveries to the front line began in early May 1917, with No. 24 Squadron being the first recipient, followed by No. 32 Squadron in June. Other units equipped were Nos. 41, 64 and 68 (Australian) Squadrons.

Problems with the Contstantinesco gear plagued the D.H.5 in service, frequently grounding the squadrons. Other shortcomings included tricky landing characteristics, poor performance above 10,000ft ((3,048m)and a tendency to lose height rapidly in combat. Performance was much better at lower levels and in the first battle of Ypres, D.H.5s were called into use for trench strafing. At this they were quite effective, although losses were heavy.

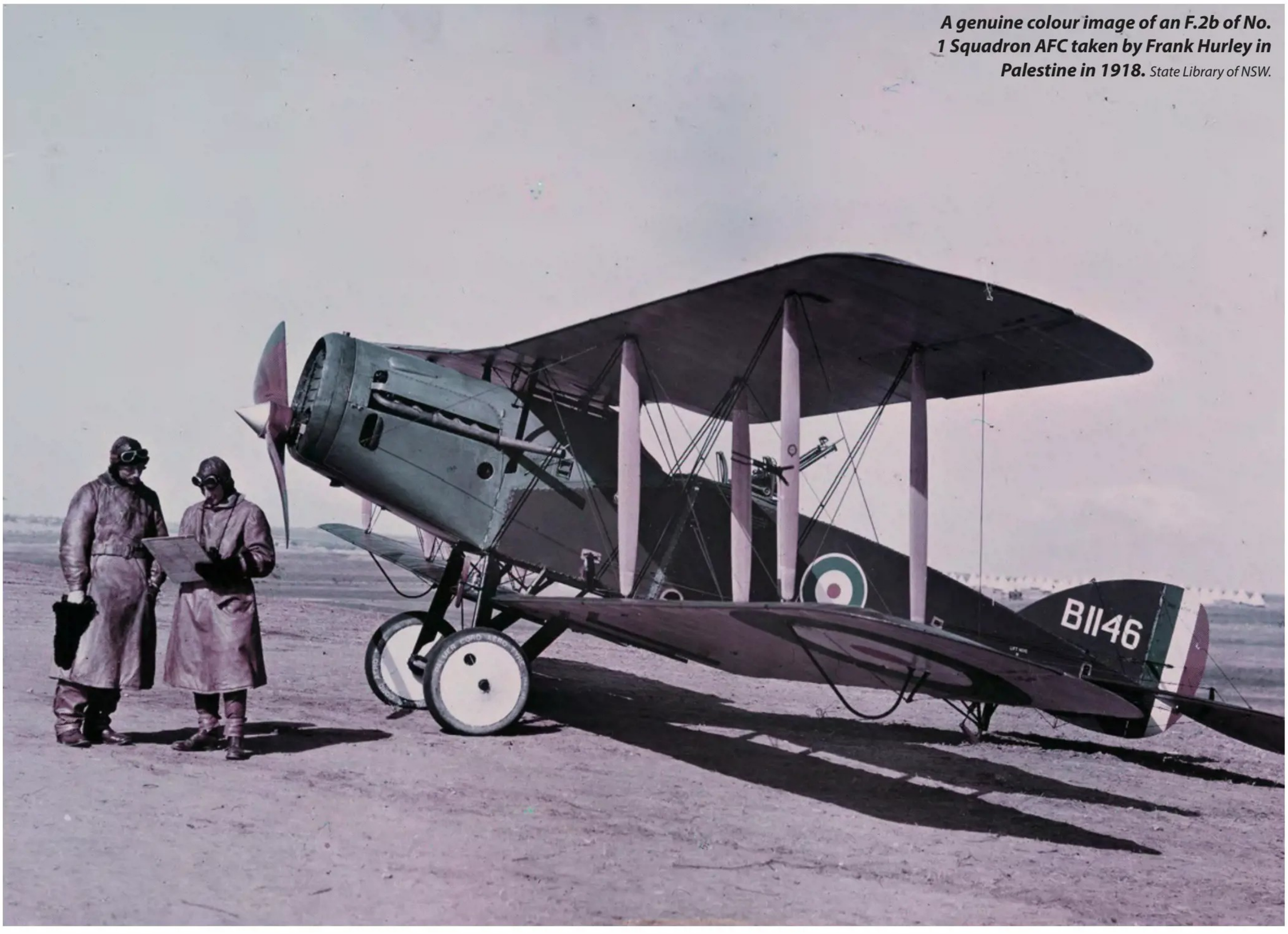
There were only seven aces on the D.H.5. The top-scorer was 2nd Lt (later Air Marshall Sir) Arthur Coningham, who claimed nine enemy aircraft – mainly Albatros D.Vs – while flying with No. 32 Squadron.

After a short frontline career, replacement of the D.H.5 began in October 1917 and the type was soon relegated to training. The engines on training machines were sometimes replaced by 100hp (76kW) Gnome Monosoupape radials. ■

Airco D.H.5

Crew: One
Length: 22ft 0in (6.71m)
Wingspan: 25ft 8in (7.82m)
Height: 2.78m (9ft 2in)
Empty weight: 1,010lb (458kg)
Max T/O weight: 1,492lb (677kg)
Powerplant: One Le Rhône 9J rotary piston engine rated at 110hp (82kW)
Max speed: 102mph (164km/h)
Service ceiling: 16,000ft (4,877m)
Endurance: 2hr 45min
Armament: One Vickers 0.303in machine-gun; four 20lb bombs

A Bristol Fighter leads an R.E.8 and a B.E.2 on patrol. The F.2 is genuine, while the other two are replicas operated by the Vintage Aviator Ltd at Masterton, New Zealand. *Gavin Conroy*



A genuine colour image of an F.2b of No. 1 Squadron AFC taken by Frank Hurley in Palestine in 1918. *State Library of NSW.*

Bristol F.2 Fighter

The Brisfit

After a disastrous combat debut the Bristol F.2 went on to be one of the most successful aircraft of the war and served well into the 1930s.

By mid-1915 the War Office was seeking a replacement for the B.E.2. The Royal Aircraft Factory R.E.8 was the designated successor, but although it would be built in large numbers (over 4,000), the 'Harry Tate' was never regarded as a great design. Bristol's Frank Barnwell knew he could do better and drew up a two-seat R.2a (R for reconnaissance) design with the two cockpits mounted closely together. This showed more promise as a fighting aircraft and the designation changed to F.2a. for Fighter.

The forward-firing Vickers gun was mounted with its muzzle protruding through the nose via a channel in the fuel tank. The propeller was protected by a Constantinesco-Colley synchronisation gear and the gun could be charged and cleared from the cockpit. Warm air from the engine also stopped the gun oil freezing at higher altitudes.

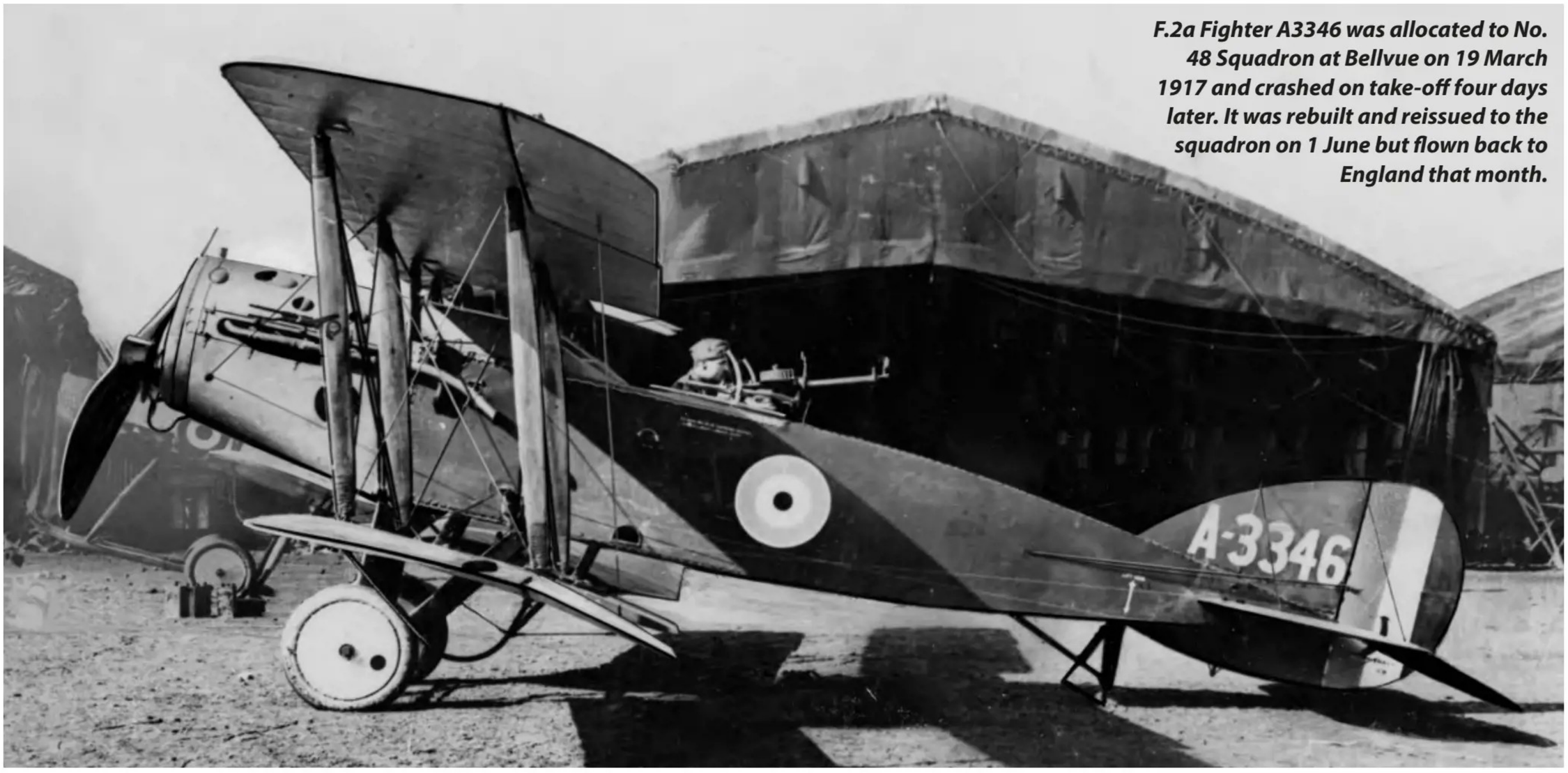
The wings were derived from those of the B.E.2d and the lower mainplane was separated from the fuselage. On the prototype, endplates were fitted at the wing roots and there were large flank-mounted radiators, which obscured the pilot's view.

Although the intended power plant was the 190hp (142kW) Rolls-Royce Mk I engine, later known as the Falcon, the second prototype, A3304, was fitted with a 150hp (112kW) Hispano-Suiza. Many engine types would be fitted in service, retrospectively receiving Bristol Type Numbers: the R.2 was the Type 9; the F.2a the Type 12; the F.2b the Type 14 (Falcon engine); Type 15 (Arab); Types 16 and 17 used the 200hp (149kW) and 300hp (224kW) Hispano-Suiza, respectively.

The first prototype, A3303 flew on 9 September 1916 and was quickly sent to the Central Flying School (CFS) to evaluate its handling qualities. At first, the F.2a proved reluctant to climb above 6,000ft (1,829m).

Vickers' chief test pilot (Frank Barnwell's brother Harold) was called in for a second opinion. He found that the altimeter was faulty and that 10,000ft (3,048m) was easily reached by the F.2.

A few changes were necessary, however. The wingroot end-planes were removed and the centre-section gap closed. A new radiator was fitted in the nose, improving the view. A3303 was later sent to the armament research station at Orfordness, but was used at least once operationally, unsuccessfully pursuing



F.2a Fighter A3346 was allocated to No. 48 Squadron at Bellvue on 19 March 1917 and crashed on take-off four days later. It was rebuilt and reissued to the squadron on 1 June but flown back to England that month.

the 18 Gotha bombers that raided London on 7 July 1917.

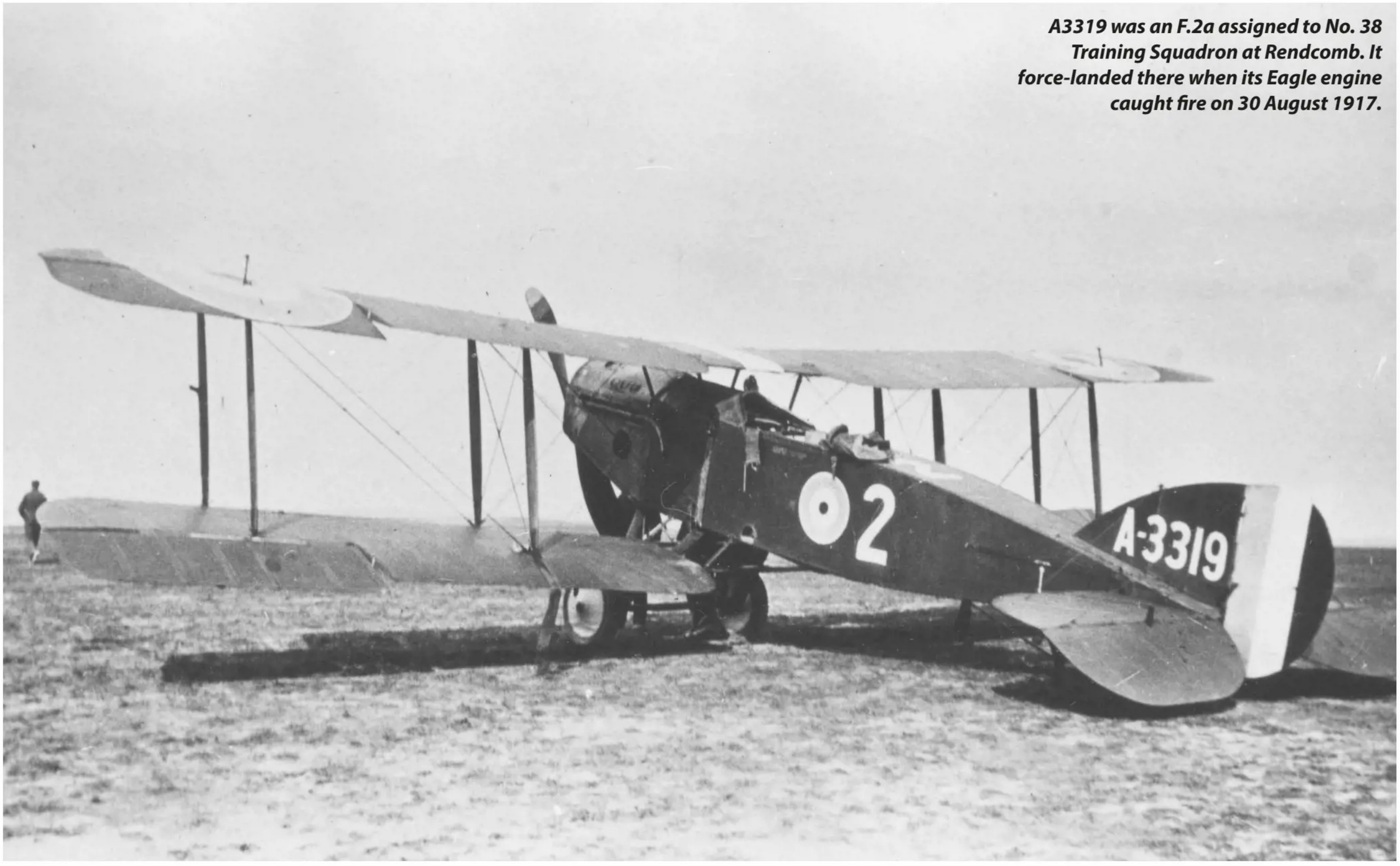
The first unit equipped with the F.2a was No. 48 Squadron, based at Rendcomb, which moved to La Bellevue, France in March 1917. The squadron adopted traditional two-seater tactics, which were to fly in close formation and for the pilots to manoeuvre to give the observers a good field of fire. These proved inadequate against single-seat fighters and on the type's air combat debut on 5 April 1917, a patrol of six F.2As was attacked by five Albatros D.IIIs of Jasta 11 led by Manfred von Richthofen. Four Bristols were quickly shot down, two of them by the 'Red Baron' himself, and their leader, Capt W Leefe-Robinson VC, was made prisoner. Things were even worse on the unit's next missions: four were shot down on 9 April and a week later, six ran out of fuel and force-landed behind enemy lines.

A change of tactics saved the F.2's reputation: the pilot flew like a fighter with the observer dealing with rear attacks. With only a single forward-firing gun, however, squadrons sought to increase the firepower and a common modification was to mount a Lewis gun above the top wing.

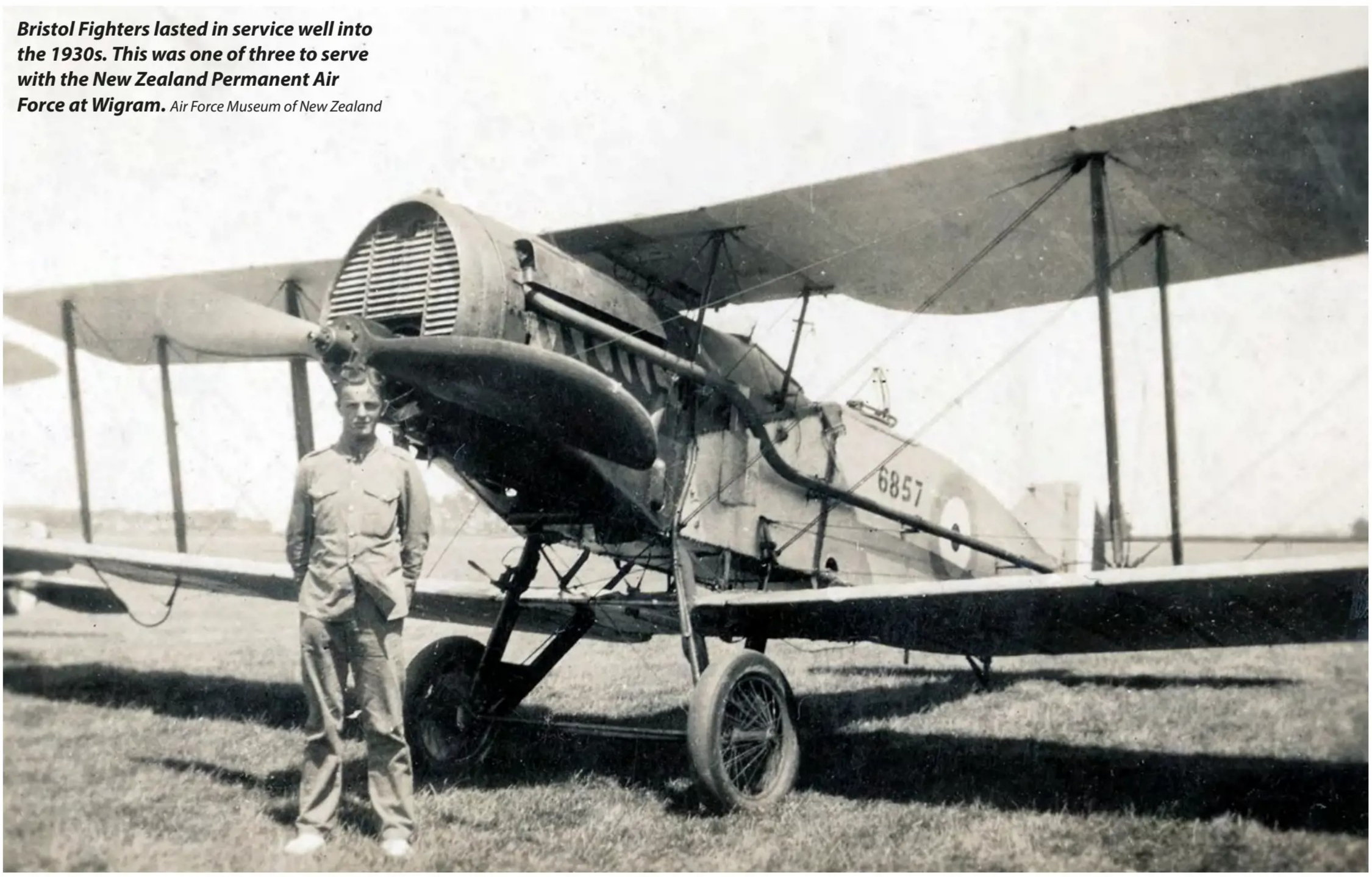
Canadian pilot Andrew McKeever of No. 11 Squadron was the top pilot ace with 31 victories, almost all of them against Albatros single-seaters. Observer Charles Gass of No. 22 Squadron scored 39 while flying with four different pilots. Another notable ace was Keith Park of No. 48 Squadron, with 20 victories. Park was later to command No. 11 Group during the Battle of Britain.

The Fighter also served on home defence duties. On 19 May 1918 during the last aeroplane raid on Britain, a No. 141 Sqn F.2b from Biggin Hill, crewed by Lts Edward Turner and Henry Barwise shot down a Gotha G.V. bomber.

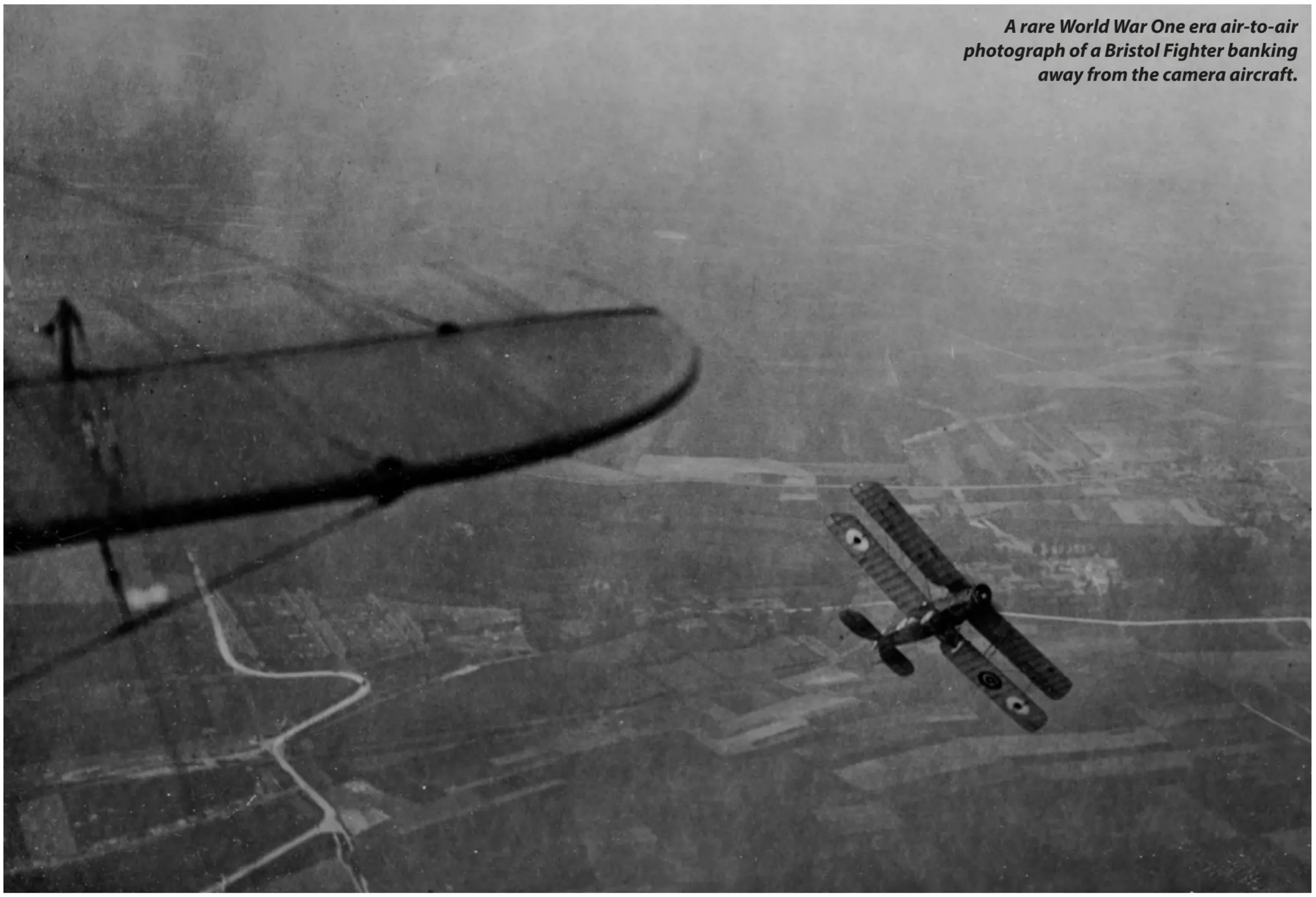
F.2b D8078 flew with Nos 34 and 139 Squadrons in Italy in 1918 and survived the war. *NASM*



A3319 was an F.2a assigned to No. 38 Training Squadron at Rendcomb. It force-landed there when its Eagle engine caught fire on 30 August 1917.



Bristol Fighters lasted in service well into the 1930s. This was one of three to serve with the New Zealand Permanent Air Force at Wigram. *Air Force Museum of New Zealand*



A rare World War One era air-to-air photograph of a Bristol Fighter banking away from the camera aircraft.

From October 1917, large contracts for F.2bs were issued. Many sub-contractors built Fighters, including Standard Motors, Gloucestershire Aircraft, Armstrong-Whitworth and Marshall & Sons, even shoplifting company Harris & Sheldon. In September 1918, 600 were ordered from Austin Motors. Because of the Armistice, only one was built, with a Puma engine. Shortages of Falcon engines led to many Fighters being stored at Filton and not delivered until after the war.

The US Army Air Service wanted 4,000 F.2bs with the 400hp Liberty 8 V-12 engine. The installation in the Fighter was not well done and made the aircraft overweight. The nose was more aerodynamic than the Falcon-engined Fighters, but large radiators stuck out at the sides. Fewer than 70 Liberty-engined F.2bs were built and only 27 of them were accepted by the USAAS by the Armistice.

Production ended in 1920 after 5,329 deliveries from all lines, but the RAF continued to accept rebuilt aircraft. Variants included Mk IIs with oleo landing gear and enlarged tyres. Those destined for colonial use had a tropical radiator. The Mk III, introduced in 1926 and IV, in 1928 had a strengthened structure. The last 30 Mk IIIs were configured as dual-control trainers. Mk IVs had a taller fin and rudder, a lengthened tail skid and a message pick-up hook. They also featured Handley-Page wing slots.

There were at least 25 trainer conversions of Mk IVs, these omitting the message hook and having a second cockpit with dual controls and a windscreen. The Oxford and Cambridge University Air Squadrons used them up to 1931.

Three Australian Flying Corps Squadrons (nos. 1, 3 and 7) flew the F2.B in the Middle East. RAF squadrons that flew the F.2b overseas at one time or another after 1918 included Nos. 2 (China), 4 (Turkey), 5, 20, 28, 31 and 48 (India), 6 (Iraq), 14 and 111 (Palestine) and 208 (Egypt).

In an early example of a rapid RAF deployment, a dozen F.2bs of No.4 Squadron flew off HMS Argus to land in Turkey during the late-1922 Chanak Crisis when forces under Kemal Bey (later Ataturk) threatened the British-protected neutral zone around Gallipoli. The presence of the RAF's Constantinople Wing helped avoid a British-Turkish war.

There were numerous foreign operators. King George V presented Poland with 32 Sunbeam Arab-powered F.2bs in 1920. A dozen Hispano-powered Mk IVs were sold to Spain in 1924, and six Falcon-powered Mk IIs to the Irish Free State in 1925. Other users included Canada, Greece, Honduras, Mexico, Norway and Peru.

Two were supplied as Imperial Gift aircraft to New Zealand in 1919 and a further two arrived in 1925 and three in 1927. Used by the New Zealand Permanent Air Force (NZPAF) as pilot refresher trainers and for army co-operation and survey aircraft, the last was retired to instructional use in 1936. ■

Bristol F.2b Fighter

Crew: Two
Length: 25ft 10in (7.87m)
Wingspan: 39ft 3in (11.96m)
Height: 9ft 9in (2.97m)
Empty weight: 2,150lb (975kg)
Max T/O weight: 3,250lb (1,474kg)
Powerplant: One Rolls-Royce Falcon III V-12 piston engine rated at 275hp (205kW)
Max speed: 123mph (198km/h)
Service ceiling: 18,000ft (5,486m)
Range: 368 miles (593km)
Armament: One forward-firing Vickers 0.303in machine-gun and one or two Lewis 0.303in guns in rear cockpit; up to 12 20lb bombs

S.E.5a F904 saw service in France with No. 84 Squadron in 1918. Since 1959 it has flown with the Shuttleworth Collection as G-EBIA.

Royal Aircraft Factory S.E.5

The Fighter from Farnborough

The S.E.5 was one of the best fighters of World War One. While it had a distinguished combat career, its impact over the Western Front could have been greater had problems with its powerplant been solved earlier.

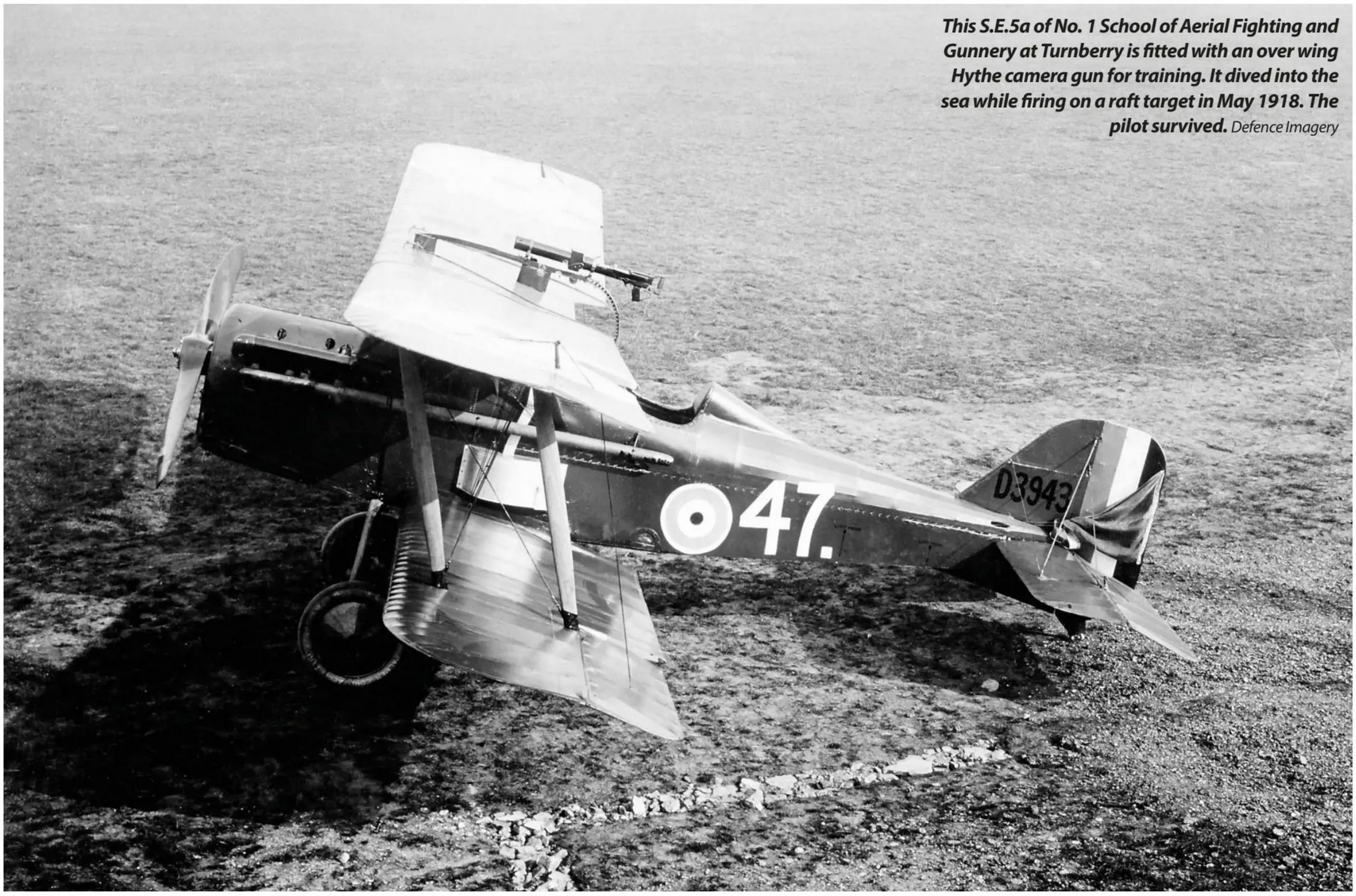
In early 1916 Maj. Gen. Hugh M. Trenchard, then commander of the RFC in France, outlined specifications for a range of new aircraft that would be required that winter. They included a new fighter. Around the same time, the Director of Air Organisation, Gen. Sefton Brancker, invited the Royal Aircraft Factory to design a single-seat fighter powered by the outstanding Hispano-Suiza 8 engine. Originating in Spain, the engine was widely built under licence in France and by Wolseley Motors in Britain.

Such an aircraft had already been outlined by Maj Frank Goodden, which had been taken up by the Factory and passed to Henry P. Folland. By mid-June 1916 the basic design had been fixed and it was designated the S.E.5 – Scout Experimental 5. As originally conceived, the aircraft would be armed with a single Lewis gun firing through a hollow airscrew shaft, while small fins were mounted above and below the fuselage.

Three prototypes were ordered as A4561 to A4563, while an initial contract for 24 was signed before the first was ready to fly. The initial prototype was completed on 20 November 1916, powered by a 150hp (112kW) direct-drive Hispano-Suiza, which could not accommodate the gun, and a fin derived from that of the RAF F.E.10. Frank Goodden completed the maiden flight of A4561 at Farnborough, Hampshire, two days later, while the next day Capt. Albert Ball flew it. The ace reportedly did not like the new aircraft.

Goodden also made the first flight of the second S.E.5, on 4 December, after which it was updated to production standard. This involved adding armament, which comprised a single fixed, synchronised Vickers gun and a Lewis gun on a Foster mounting on the upper wing. A large windscreen was added, designed to protect the pilot should he have to stand to unjam the Vickers gun. A gravity fuel tank installed in the upper wing replaced that in the leading edge of the port top wing. Goodden flew A4562 to France on Christmas Eve 1916 after modification for evaluation by RFC pilots, returning to Farnborough on 4 January for the minor alterations they suggested to be incorporated. It flew again on 26 January, but two days later its wings folded up in the air, the crash claiming Goodden's life. He had flown the third S.E.5 prototype (A4563) on 12 January, which had a 200hp (149kW) geared Hispano-Suiza.

The first production S.E.5, similar to A4562, was completed on 1 March 1917, and it went to Martlesham Heath, Suffolk, for testing, during which its poor lateral control was criticised. All 24 of the initial order had been delivered by the end of March 1917, with the majority going to No. 56 Squadron at London Colney,



This S.E.5a of No. 1 School of Aerial Fighting and Gunnery at Turnberry is fitted with an over wing Hythe camera gun for training. It dived into the sea while firing on a raft target in May 1918. The pilot survived. *Defence Imagery*

Hertfordshire, of which Albert Ball was a flight commander. He modified his S.E.5 (A4850) by removing the windscreen, as well as briefly replacing the Vickers with a downward-firing Lewis gun. No. 56 Squadron moved to France on 7 April 1917, where it was quicky ordered that the windscreen be removed from all its S.E.5s, a process that grounded the unit for two weeks. Ball (flying a Nieuport) led six S.E.5s on the type's first offensive patrol on 22 April; four days later, in A4850, he shot down two enemy aircraft, followed by another on the 28th. In the first five days of May he destroyed seven Albatroses, but was killed on the 7th, when his S.E.5 crashed after trailing black smoke upside down. Inspection of his aircraft found no battle damage. Of his 44 confirmed kills, 11 were achieved in the S.E.5.

Captain Ball may have been the first ace on the S.E.5, but he was no means the last; over 100 pilots would achieve five or more kills on the type, although those that followed generally flew the later, S.E.5a variant. The most successful was Andrew Beauchamp-Proctor, who destroyed 54 enemy aircraft in the S.E.5a between January and early October 1918, although James McCudden, who had 57 confirmed kills, scored all but five in the fighter and Edward 'Mick' Mannock achieved 44 of his 61 confirmed kills flying the type. Many pilots praised the S.E.5a as a stable gun platform, while it was faster than German fighters at height, relatively manoeuvrable and its pilots could always dive away from trouble with few able to catch it. It was also easier and safer to fly than the Camel, taking less of a toll of novice pilots.

As production built up after a second order for 50 was placed in December 1916. As production was under way the wingspan was reduced slightly by shortening the rear spars and revising the ailerons to improve lateral

No. 74 Squadron S.E.5As at Clairmarais South, France. The squadron's ace pilots at the time included the CO Keith Caldwell (17 victories) and 'Mick' Mannock (61). *Air Force Museum of New Zealand*

control, while the 200hp Hispano-Suiza became standard. It is the latter change that has become associated with the S.E.5a designation, although it should be noted that several other closely-related engines, notably the Wolseley Viper, were also used. Aircraft powered by 150hp engines were gradually replaced in the summer of 1917, although some were modified to accept 200hp units.

Large scale production of the S.E.5a was initiated in February 1917 with contracts issued to Martinsyde and Vickers for 200 each, with deliveries beginning that July. In service the 200hp Hispano-Suiza proved troublesome, with faults dependent on which company built the engine, although all suffered from inadequate lubrication. Minor differences in reduction-gear ratios and other components meant that parts built for engines assembled by one company could not be used in those of another, creating problems sourcing spares. In November 1917 the 200hp Sunbeam Arab was tested in around half a dozen S.E.5as, but had its own problems. By January 1918 approximately 400 S.E.5a airframes were stored awaiting a suitable engine, seriously disrupting the flow of the fighter to frontline squadrons.

It can be argued that the problems with the engine robbed the S.E.5a of its place in history as the great British fighter of World War One. Although it entered service before the Sopwith Camel – another contender for that title – only three squadrons (Nos 56, 60 and 84) flying on the Western Front had received S.E.5as by November 1917, although they were joined by Nos 40 and 41 Squadron during that month. In December No. 68 Squadron replaced its Airco DH.5s with the aircraft and became No.2 Squadron of the Australian Flying Corps (AFC) on 19 January 1918, while the first S.E.5a for No. 24 Squadron had been received on Christmas Day.

A total of ten RFC/RAF squadrons would fly S.E.5as on the Western Front, plus No. 2 Squadron of the AFC. Others served with Nos 17 and 47 Squadrons in Macedonia, with No. 72 Squadron in Mesopotamia and No. 111 Squadron in Palestine. A further three (Nos 37, 39 and 61) operated as Home Defence units in Britain, although its water-cooled engines, (which took longer to warm-up before they could take off) limited its adoption by such squadrons. A further four squadrons were mobilising with the S.E.5a at the time of the Armistice. Many units, including 11 training squadrons, had S.E.5/5as on charge for instruction on the type or military flying, while a small number of the aircraft were modified as two-seat trainers.

In addition to problems with the engine, there were structural issues with the fin and

A classic image of No. 85 Squadron at St Omer on 21 June 1918. The serials of the S.E.5as have been obscured by the censor.

Riggers work on an S.E.5a while a Triplane is dismantled in the background. B4563 is actually the serial of a B.E.2e.

D5995 was flown as a night fighter by No. 29 Squadron in mid-1918. Note the subdued markings and the flame suppressor on the exhaust pipe.

trailing edge of the mainplanes, while the steel tubing used in the landing gear struts proved inadequate for operations from airfields on the front. Cures for all three maladies were implemented, resulting in the airframe gaining a reputation for being strong and able to absorb punishment.

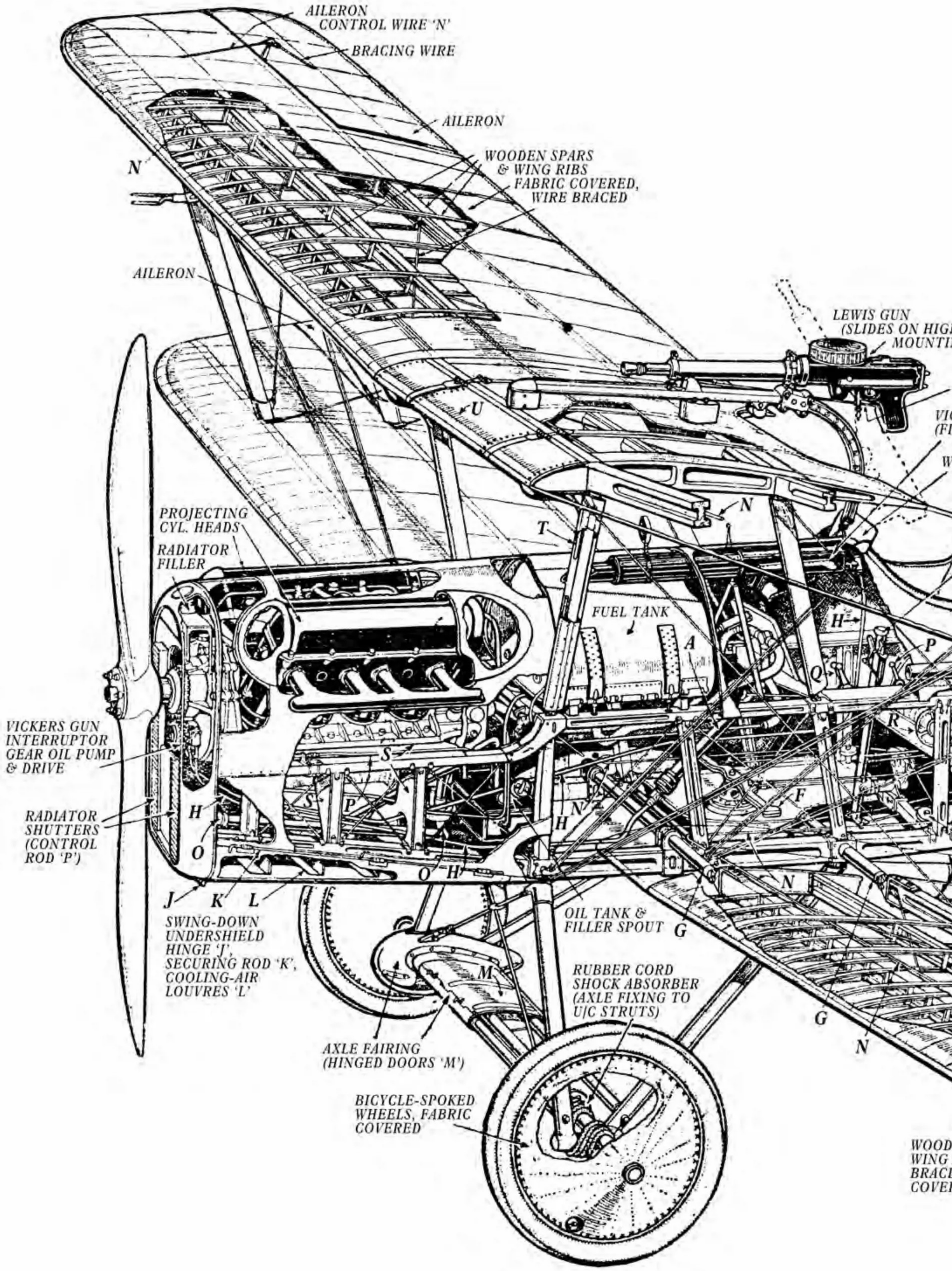
During January 1918 supplies of French-built Hispano-Suizas began to arrive, allowing the backlog of airframes to be delivered. Wolseley also continued to work on derivatives of the Hispano-Suiza 8. In May 1917 the company had been asked to build 400 examples of the direct-drive 150hp unit, but the instructions were either not clear (or wilfully ignored) and instead a high-compression power unit of 200hp was created as the W.4A Viper. Wolseley also built a geared Hispano-Suiza as the W.4B Adder, although it did not overcome the basic flaws of the original engine. Thus it was the Viper that became the standard engine fitted to most late production S.E.5as; most of the examples in France in October 1918 were powered by the Viper. SE5as continued to serve in RAF fighter squadrons into 1919, but the type was largely withdrawn towards the end of that year. The last operational squadron, No. 56 at Bircham Newton, Norfolk, retired them in January 1920.

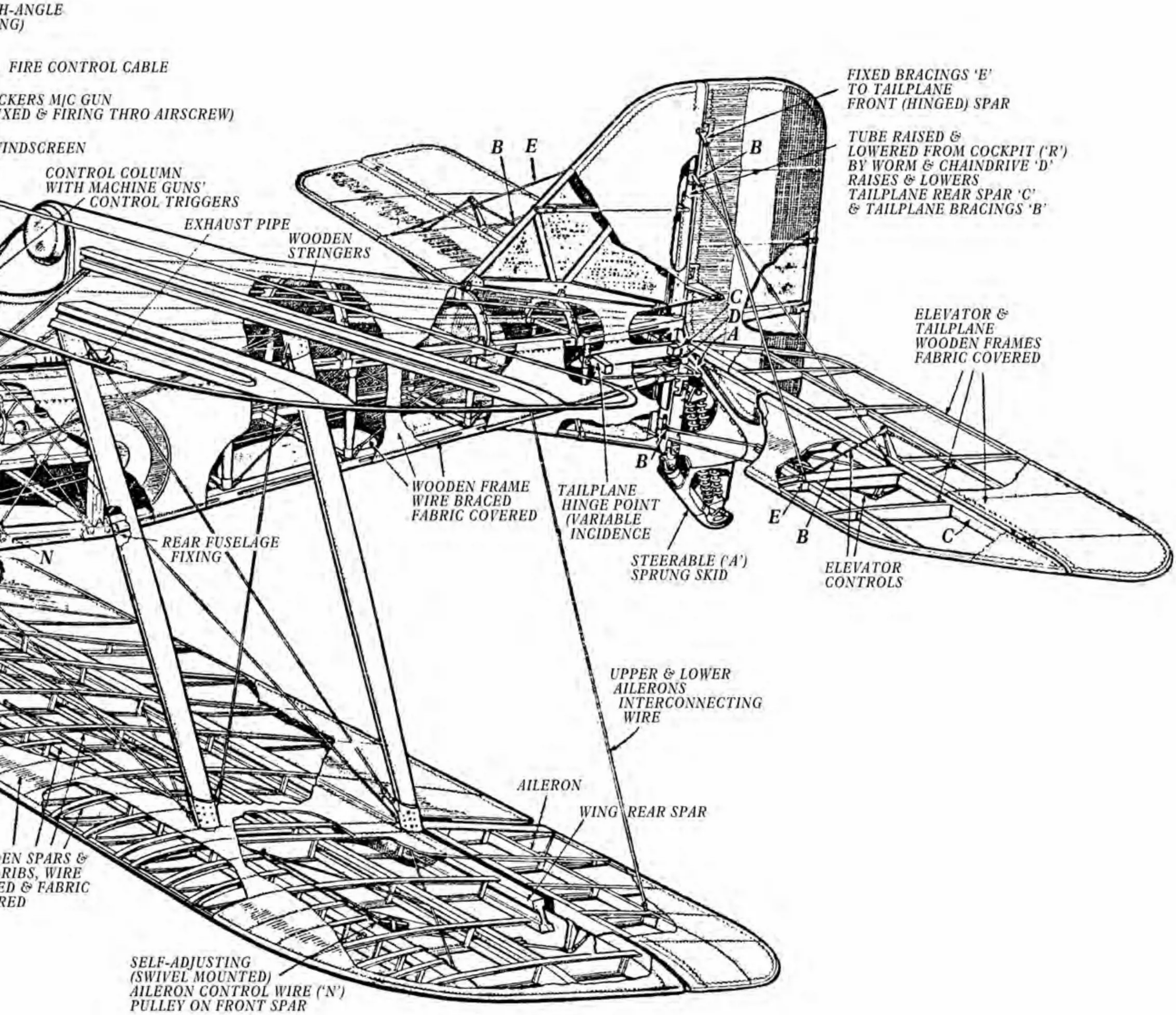
In addition to the Royal Aircraft Factory (200 produced), S.E.5/5as were built in Britain by Austin Motors (1,650), Blériot & SPAD Manufacturing Co (560), Martinsyde (258), Vickers (2,164) and Wolseley Motors (431). Like many aircraft of the Great War, the exact number produced is difficult to ascertain, due to cancellation of partially completed aircraft and non-acceptance of others already built, while at least 58 were rebuilt and issued new identities, but is understood to be around 5,265. In addition to those built by the companies listed above, a single example was assembled by the Curtiss Aeroplane and Motor Company in the United States. Curtiss was due to produce around 1,000 S.E.5s to augment the 38 supplied to the American Expeditionary Force in France, but only the one had been built before the contract was cancelled at the end of the war. Post-war, a further 56 S.E.5as were completed in America for the US Army Air Service out of existing components supplied from Britain. Around 50 were refurbished by Eberhart Aeroplane as SE-5Es from 1922, their fuselages recovered by plywood and 180hp Wright-Hispano Es installed. They were used for advanced training until the end of the decade. ■

Royal Aircraft Factory S.E.5a

Crew: One
Length: 20ft 11in (6.37m)
Wingspan: 26ft 8in (8.11m)
Height: 9ft 6in (2.87m)
Empty weight: 1,531lb (694kg)
Max T/O weight: 2,048lb (929kg)
Powerplant: One Hispano-Suiza 8B V-8 piston engine rated at 200hp (150kW)
Max speed: 126mph (203km/h)
Service ceiling: 17,500ft (5,180m)
Endurance: 2hr 15min
Armament: One 0.303in Vickers and one 0.303in Lewis machine-gun

Royal Aircraft Factory S.E.5a




H-ANGLE
NG)
FIRE CONTROL CABLE
CKERS M/C GUN
XED & FIRING THRO AIRSCREW)
INDSCREEN
CONTROL COLUMN
WITH MACHINE GUNS'
CONTROL TRIGGERS
EXHAUST PIPE
WOODEN
STRINGERS
FIXED BRACINGS 'E'
TO TAILPLANE
FRONT (HINGED) SPAR
TUBE RAISED &
LOWERED FROM COCKPIT ('R')
BY WORM & CHAINDRIVE 'D'
RAISES & LOWERS
TAILPLANE REAR SPAR 'C'
& TAILPLANE BRACINGS 'B'
B
E
B
C
D
A
B
ELEVATOR &
TAILPLANE
WOODEN FRAMES
FABRIC COVERED
WOODEN FRAME
WIRE BRACED
FABRIC COVERED
TAILPLANE
HINGE POINT
(VARIABLE
INCIDENCE
E
B
C
N
REAR FUSELAGE
FIXING
STEERABLE ('A')
SPRUNG SKID
ELEVATOR
CONTROLS
UPPER & LOWER
AILERONS
INTERCONNECTING
WIRE
AILERON
WING REAR SPAR
EN SPARS &
RIBS, WIRE
ED & FABRIC
RED
SELF-ADJUSTING
(SWIVEL MOUNTED)
AILERON CONTROL WIRE ('N')
PULLEY ON FRONT SPAR

Reproduction Camel ZK- JMU is painted as B3889 as flown by New Zealand ace Clive Collett of No. 70 Squadron. *David Evans*

Sopwith Camel

The 'Hun-killer'

Unarguably the most famous and successful British fighter aircraft of World War One, and perhaps of all time, the Camel was famously tricky to fly, but a deadly adversary in the right hands.

The Camel was the creation of T. O. M. Sopwith, Fred Sigrist and Harry Hawker, although R. J. Ashfield and Herbert Smith worked on the initial design. The primary production variant was the F.1, of which just under 5,500 were built for the RFC, RNAS and RAF. It was designed as a two-gun land-based fighter, building upon the company's experience with the Baby floatplane as well as the Pup. The first F.1 prototype was built by the Sopwith Experimental Department at Brooklands, Surrey, where it 'passed out' on 22 December 1916, having completed all required ground tests. The unserialled aircraft had a one-piece upper wing without the centre section cutout, a sloping 'hump' in front of the cockpit and was powered by a 110hp (82kW) Clerget 9Z rotary engine. Harry Hawker completed its maiden flight just after Christmas 1916, with three other prototypes following it into the air in the early months of 1917.

The second was known as the F.1/1. It featured tapered wings with a cutout in the trailing edge of the upper wing above the pilot, a revised hump and the more powerful 130hp (97kW) Clerget 9B. The third aircraft was the F.1/2, a naval prototype believed to be N517, which introduced a three-piece top wing and a small windscreen, while retaining the F.1/1's hump. It first flew on 27 February 27, 1917, at Brooklands, before going to the RNAS for evaluation. The last was F.1/3, originally powered by a Clerget 9Z, which was delivered to Martlesham Heath, Suffolk, for testing on March 24, 1917, where it was later fitted with a 110hp Le Rhone 9J and then Clerget LS (9Bf). Although built with the original one-piece upper wing and short ailerons, it effectively became the prototype for subsequent production F.1s. It was while at Martlesham Heath that the aircraft it believed to have received its name.

How the aircraft was christened the Camel is usually attributed to the 'hump' in front of the cockpit, which covered the rear parts of the two Vickers guns but restricted the pilot's view forward. Another explanation for the name concerns the lack of dihedral on the upper wing and the high degree of it on the lower set, giving the aircraft a 'humped-back' appearance. It has also been stated that a pilot, directed to fly F.1/3 at Martlesham, got the 'hump' at the thought of it.

The first production contract for 40 F.1s was placed with Sopwith by the RNAS; deliveries began on 7 May 1917, while 18 days later another 250 were ordered with assembly contracted out to Rushton Proctor of Lincoln. The final F.1 prototype was N518, a second for the RNAS. Tested in May 1917, it was powered by an Admiralty Rotary No.1 (AR1), later renamed the BR1 (Bentley Rotary No.1). BR1-powered

A Camel with a single Vickers gun and a Lewis gun mounted above the wing seen at Turnhouse, Edinburgh. The pilot is believed to be Canadian Lt William S. Lockhart.
rchives of Canada.

Camels became the first issued for operations in France, going to No. 4(N) Squadron, RNAS, based at Dunkirk, by June 1917. On the 4th Flt Cdr Alexander M. Shook of the squadron may have been the first to use the Camel in action, attacking an enemy aircraft that escaped by diving away. The next day the same pilot shot down an enemy scout, while another was claimed to be out of control. Flt Sub-Lt Chadwick of No.4 (N) Squadron achieved another kill flying a Camel on 25 June. During July, No. 6(N) Squadron became the second to re-equip with Camels, while another six naval units also began receiving the fighter that month.

Ruston, Proctor-built Camel 1F.1 B7320 served with No. 70 Squadron in early 1918 and appears to have survived some battle damage. It later flew with No. 86 Squadron at Northolt.

The initial RFC Camel unit was No.70 Squadron, which replaced its Sopwith 11/2 Strutters at Fienvillers. Capt. Clive Collett scored the squadron's initial victory using its new mounts on 27 June 1917, and No. 70 had received its full complement by the end of July. The second RFC Camel squadron was No. 45; by the end of that year, nine RFC units were flying Camels on the Western Front. Camels went on to be operated by 12 RFC and 18 RAF squadrons over the Western Front, while the fighter also served on the Italian Front (with three squadrons), in the Adriatic (four), Aegean (three), Macedonia (three squadrons and a flight) and Mesopotamia (one squadron and one flight).

Other Allied air arms had Camels during the war. The Royal Australian Flying Corps' No. 4 Squadron used them over the Western Front, while three other squadrons were based in Britain. From 1918 three or four Belgian squadrons had Camels, which also equipped five Aero Squadrons of the US Army Air Service (USAAS), the United States eventually receiving 325. The Royal Hellenic Naval Air Service flew Camels in the Aegean theatre.

In service the Camel proved to be divisive; pilots either loved it or loathed it. The aircraft was manoeuvrable but tricky to fly – 'twitchy' in

Clerget-engined Camels of No. 45 Squadron prepare for take-off in Italy, circa October 1917.

the vocabulary of the day. The concentration of weight in the forward section, where the engine, pilot, fuel, guns and ammunition were situated, was key to the Camel's manoeuvrability. Camel pilots also made use of the gyroscopic effect of the rotary engine to rapidly make right turns. With extremely sensitive and powerful elevators and ailerons, a lightly-loaded and small airframe, the Camel was a handful to fly, but a great dogfighter once mastered. This contrasted with the more stable SE5, which was also slightly faster at height and unhindered by the poor view out of the Camel's cockpit. But in late 1917 and early 1918, in the hands of a capable pilot, the Camel was more than capable of holding its own.

Sopwith Camels were used to shoot down 1,294 enemy aircraft during the conflict. The leading Camel Ace, Canadian Capt. Donald MacLaren of No. 46 Squadron, was credited with 54 victories, all on Camels. Fellow Canadian Major William Barker, destroyed 46 aircraft with Nos. 28, 66 and 139 Squadrons, all while flying one aircraft, B6313. This Camel has to be one of the most successful individual fighter aircraft of all time.

The two Vickers guns of the F.1 were mounted close to each other and could fire 400 to 600 rounds a minute. During its early service career the close coupling created problems with feeding ammunition into the weapons and the ejection of spent rounds. This was alleviated by the adoption of 'handed' guns, into which ammunition could be feed from either the right side (as standard) or the left. The Camel was the first to use such 'mirrored' guns. Towards the end of the war the rate of fire was also increased, to 2,000 rounds a minute, improving the chances of downing an enemy aircraft, but at the cost of greater wear of the weapon's barrels.

The second variant was the 2F.1, created specifically for the RNAS, which knew it as the 'Ship's Camel'. It was designed to be operated from warships as a general fighter and anti-Zeppelin aircraft, flying off short, temporary platforms usually mounted over the forward gun batteries. 'Ship's Camels' also operated from lighters towed behind ships, as well as from land bases.

The 2F.1 had a slightly shorter wingspan than the F.1, with the lower unit having greater dihedral (5.5° instead of 5°), thinner centre section struts and a fuselage constructed in two parts that could easily be dismantled for stowage on ships. It usually had a single Vickers gun in the forward fuselage, allowing more fuel to be carried, plus a Lewis gun mounted over the upper wing. Many different modifications were implemented on 2F.1s in service, with examples fitted with skid landing gear, jettisonable wheels, special armament, slinging gear and lash-down points.

The prototype was N5, which arrived at Martlesham Heath on 15 March 1917, although it was preceded by the Sopwith FS.1 'Improved Baby' (possibly N4), a twin-float, single-seat fighter, similar to the F.1, about which few details have survived. The initial order covered 50 2F.1s from Sopwith, with deliveries beginning in the autumn of 1917, although William Beardmore & Co became the major source of 'Ship's Camels', handing over its first on 20 February 1918. The BR1 became the standard engine for the variant, although 130hp Clergets were also fitted in service.

'Ship's Camels' made their combat debut on June 1, 1918, flying from the Australian light cruisers HMAS *Sydney* and *Melbourne* to intercept German seaplanes, but without claiming any. The first success occurred on June 18 when a 2F.1, flown by Lt Heath from the aircraft carrier HMS *Furious*, forced a seaplane attacking the warship down into the sea. One month later, seven 2F.1s set off from *Furious* to attack the Zeppelin sheds at Tondern, in Schleswig-Holstein, with 50lb (23kg) Cooper bombs. Zeppelins L54 and L60 were destroyed in the blaze that consumed the sheds, but just two of the seven pilots that set out landed back on Furious. The raid marked the first time a land target was successfully raided by carrier-borne aircraft. On August 11, 1918, Flight Sub-Lieutenant Stuart Culley flew a 2F.1 off a lighter towed by HMS *Redoubt* to bring down Zeppelin *L53*, a feat for which he received the Distinguished Service Order.

In addition to serving on the Western Front, in other overseas theatres and at sea, Camels

Horse- and bicycle-mounted troops pass a downed Camel of No. 208 Squadron, somewhere in France, May 1918.
Archives of Canada

were also active with Home Defence squadrons. Impetus to improve air defences grew following the first Gotha bombing raid on 25 May 1917, with Camels increasingly used as night fighters from that September, despite its reputation as being tricky to fly. One problem was that muzzle flash from the twin Vickers tended to blind the pilot, resulting in the substitution of Lewis guns mounted on Foster rail slides on the upper wing. These had the advantage of being able to fire upwards at an angle of 45°, but required the cockpit to be moved slightly aft, so the pilot could reload and operate them. Balance was maintained by repositioning the fuel tank forward in the airframe. Like 11/2 Strutters used as night fighters, such Camels were unofficially known as 'Comics', a wry comment by pilots on the task of operating such aircraft in the dark. Camels served with 13 RFC/RAF Home Defence squadrons and at various RNAS air stations.

Many training units in Britain also used the aircraft. Alarm at the number of fatalities of pilots converting to the type, plans for a twin-seat training version of the F.1 were outlined in early 1918, with the drawings officially approved that October. Two-seat Camels had begun to appear in late 1917, however, after unofficial modifications were undertaken at several training establishments. Relatively few were built as such, due to the end of hostilities.

In the last year of the war Camels were used for trench strafing. While an effective tactic, it was extremely costly in pilots and machines, creating a requirement for specialised aircraft to undertake the mission. This resulted in the TF.1 Armoured Trench Fighter variant of the Camel. Just one was produced by mid-February 1918, by converting B9278, the Vickers gun being deleted in favour of two, downward-firing Lewis guns in the cockpit, plus another mounted on the top wing. The undersides of the forward section were armoured. B9278 was flown to France on 7 March, but soon returned to Britain, as Sopwith was already working on the Salamander.

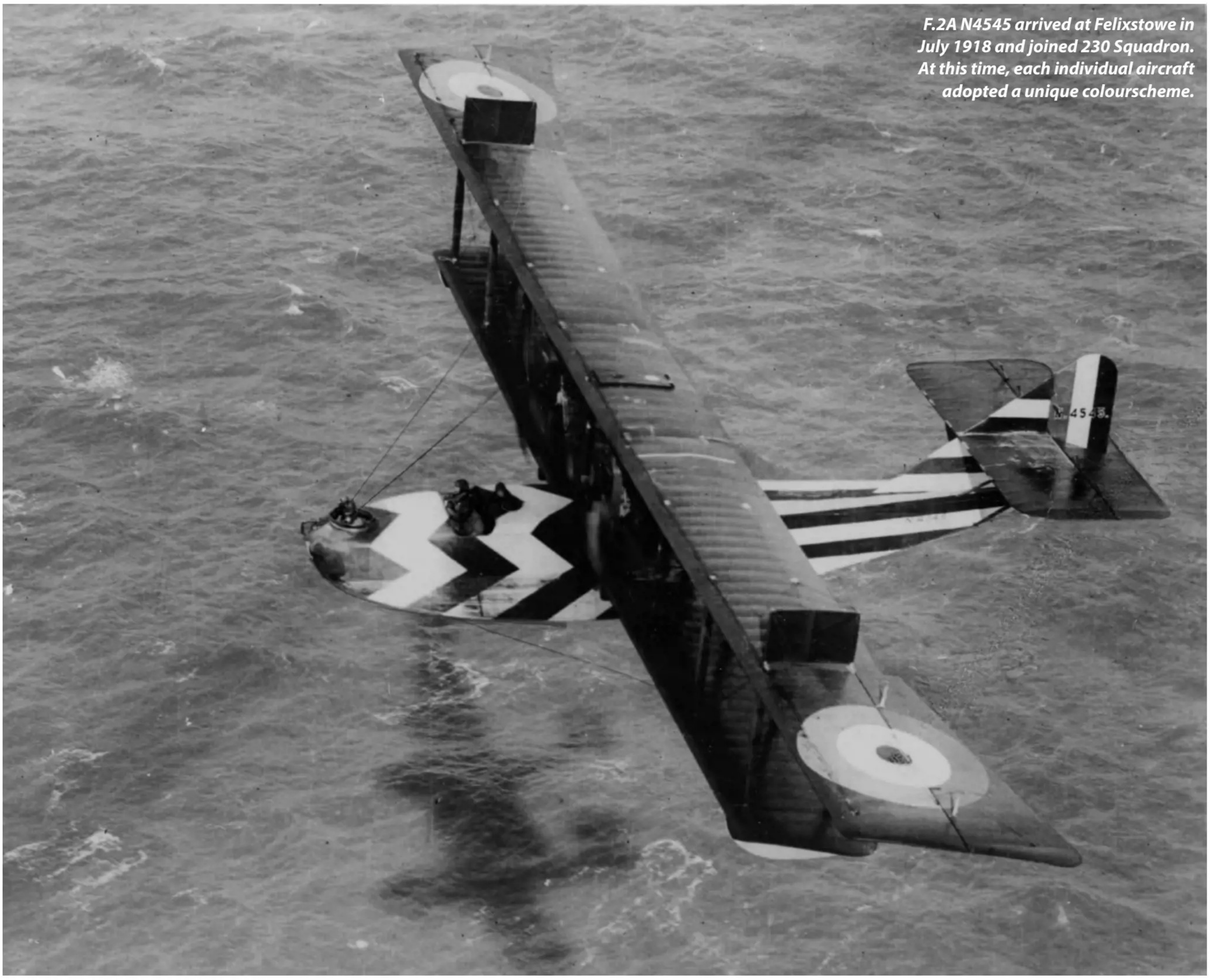
Ten firms built Camels, in addition to Sopwith. Production batches completed, or partially fulfilled, covered 5,595 F.1s, of which around 140 are unconfirmed as having been built or delivered. In addition, 20 of 297 2F.1s may not have been finished. More than 375 Camels were also rebuilt, using existing components, and received new serials. At the end of October 1918 the RAF had 2,519 Camels in service, but between June and December 1919, when it was declared obsolete, 36 squadrons flying the type disbanded.

Camels served with the British forces sent to support anti-Bolshevik operations, operating alongside the White Russians between 1918 and 1920, notably with No. 47 Squadron, which claimed around 20 kills. Most surviving RAF Camels in Russia were destroyed when the force prepared to leave, although a handful supplied to Latvian forces at the end of 1919 continued to be used into the summer of 1921 at least. Small numbers of Camels were also flown by the 'Reds', while around half a dozen gifted by the British to the Polish government were delivered in August 1920.

Relatively few US Camels crossed the Atlantic and only six remaining in service with the USAAS by late 1919. Around six were also used by the US Navy after the Armistice, notably flying from platforms mounted on the battleships USS *Arkansas* and *Texas*. Canada received some Camels as Imperial Gifts in late 1918, putting three F.1s into service at Camp Borden as refresher trainers in 1924. A further seven 2F.1s were acquired for spares in 1925, allowing the Canadian Camels to remain in service until the end of the decade. ■

Sopwith 1F1 Camel

Crew: One
Length: 18ft 9in (5.71m)
Wingspan: 28ft 0in (8.53m)
Height: 8ft 6in (2.59m)
Empty weight: 929lb (421kg)
Max T/O weight: 1,453lb (659kg)
Powerplant: One Clerget 9B nine-cylinder rotary piston engine rated at 130hp (97kW)
Max speed: 115mph (185km/h)
Service ceiling: 17,300ft (5,273m)
Endurance: 2hr 30min
Armament: Two 0.303in Vickers machine-guns



F.2A N4545 arrived at Felixstowe in July 1918 and joined 230 Squadron. At this time, each individual aircraft adopted a unique colourscheme.

Felixstowe Flying Boats

Across the Seas

An early example of transatlantic aviation cooperation, the Felixstowes fought submarines, seaplanes and even Zeppelins and established the traditions of long-range maritime patrol.

Former RNAS officer John (Cyril) Porte and American aviation pioneer Glenn Curtiss worked together on a design for a flying boat to compete for a large prize for the first aeroplane crossing of the Atlantic. This emerged as the Curtiss America, which flew on June 23 1914, but the record attempt was put off with the outbreak of war, Porte returned to England and was recommissioned and appointed commander of the RNAS Felixstowe air station in Suffolk. Here he worked tirelessly on the development and operational use of large flying boats.

At Porte's recommendation, the RNAS purchased H-4s, versions of the Curtiss America. These proved somewhat underpowered until re-engined first with Anzani radials and then with Rolls-Royce Falcon V12 engines, after which they were designated H-12 and known as 'Large Americas'. The H-4s became 'Small Americas'.

One drawback of the Curtiss design was that the continuous curve of its hull created suction, leading to excessive take-off runs, but Porte realised that building a 'step' into the underside of hull overcame this as the aircraft began to leave the water. The wings of an H-4 were combined with a new British-built hull known as the Porte I type. This aircraft, Felixstowe F.1 No, 3580, flew with a single-step hull, but later two more steps were added. Marrying the wings and tail of the H-12 with a Porte hull created the F.2.

The main hull was constructed with diagonal planking and plywood side fins. The forward superstructure was plywood. The wings and tailplanes were wood covered in linen, with

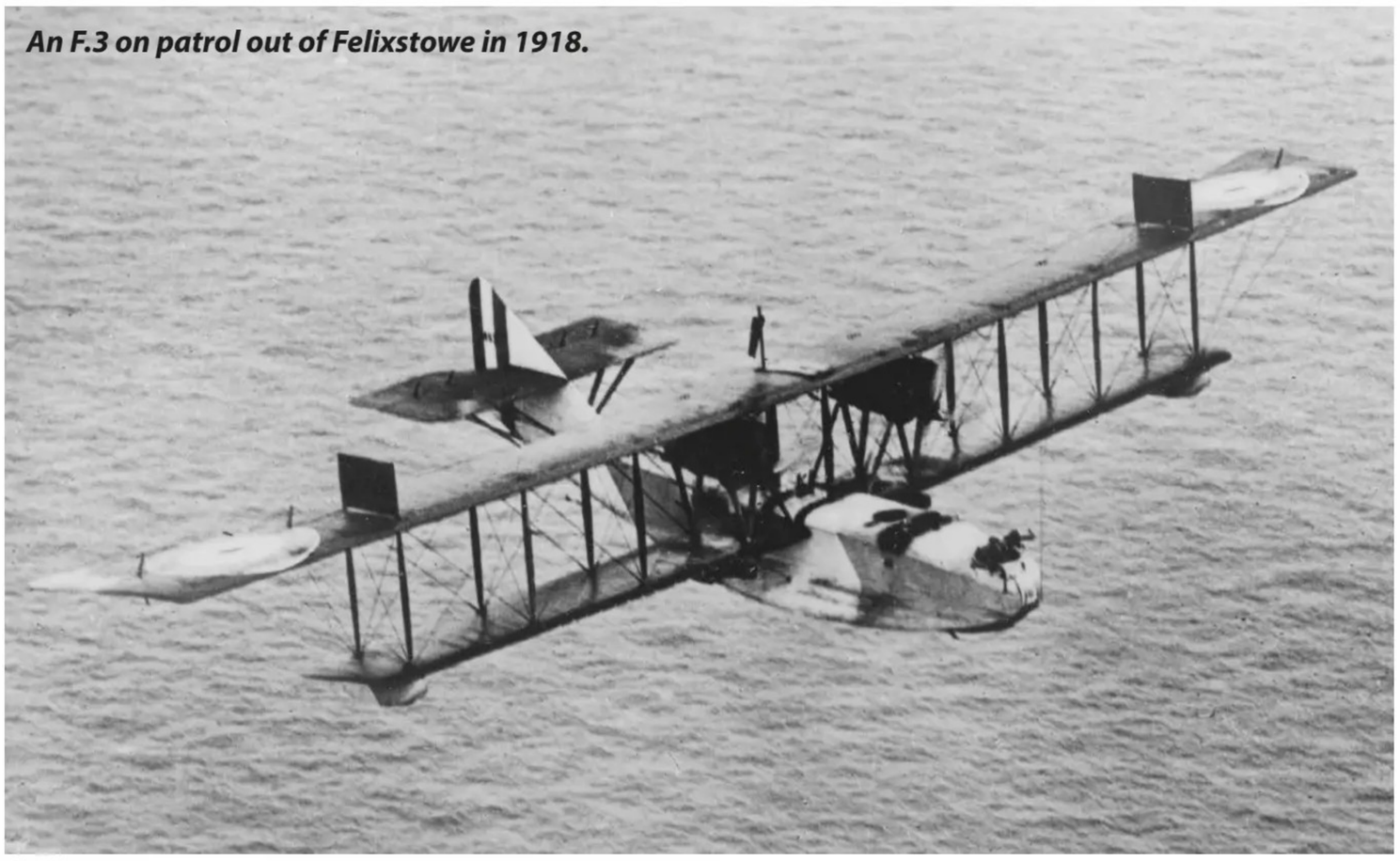
The F.3 was a development of the F.2A although it was not regarded as a great improvement. Note the enclosed canopy, which was omitted from many aircraft.

plywood walkways. The rear fuselage of early examples was fabric-covered, but this was later changed for plywood skinning. An advantage of the new hull design was that it could be produced by firms without previous boat-building experience, which greatly expanded the rate at which they could be made.

Deliveries of F.2s began in late 1917, followed by the F.2A with Rolls-Royce Eagles later in the year. The F.2A is considered the most successful of the family. It could stay aloft for over nine hours if its tanks were refuelled from onboard petrol cans. It had dual control, allowing some relief to the pilot. For better visibility and reduced drag, the cockpit canopy was often removed in service and was omitted from late-production aircraft. Aircraft so modified are occasionally called F.2Bs, although no such official designation existed.

The F.2s were assigned to stations at Calshot, Dundee, Felixstowe, Great Yarmouth, Killingholme, Scapa Flow and Tresco in the Scilly Isles. Their main role was anti-submarine patrol. Although engagements with German submarines were rare, the presence of a flying boat was enough to keep them below the surface, consuming valuable battery power. The Felixstowes made various claims against German submarines. Some sources say that on 20 May 1917 *UC-36* was first submarine ever sunk by an aircraft.

Another submarine was attacked by five flying boats from Felixstowe on 24 July 1917 and minelaying sub *UC-1* was claimed destroyed, although it is more likely that it hit a mine itself. It is possible that the actual victim was *UB-27*, which also failed to return from patrol around that time. Aboard one of the flying boats was Cyril Porte.



An F.3 on patrol out of Felixstowe in 1918.

The F.2A was used for experiments with detecting submarines with a hydrophone. The aircraft would alight on the water and swing out the device on a boom and listen for the motors of submerged U-boats.

Felixstowe flying boats also tangled with enemy aircraft. The first air-to-air claims made by U.S. Navy personnel were by F.2A crewmen flying with the RNAS. Ensigns Stephen Potter and Nugent Fallon were awarded a quarter victory credit each for downing German seaplanes while flying from RNAS Felixstowe. On 4 June 1918 a formation of four F.2As from Felixstowe and Great Yarmouth fought with 14 German seaplanes, downing six of them for one flying boat forced down.

Curtiss and Felixstowe flying boats were credited with two airships. German Zeppelin *L-22* was destroyed by H-12 No. 8666 on 14 May 1917, and F.2A N4291 'Black Bess' shot down *L-62* on 10 May 1918.

The larger F.3 could boast longer range and a heavier payload than the F.2A, but was slower and less manoeuverable. Contracts for 263 F.3s were issued to Short Brothers; Dick, Kerr & Co and Phoenix Dynamo Manufacturing. Many of these were cancelled with the Armistice but about 100 were completed. F.3s were assigned to stations at Felixstowe, Cattewater, Houston Bay and Tresco. At least 18, which were built in the dockyards in Malta, also served in the Mediterranean.

Some F.3s were finished as the F.5 with a further-improved hull design, and the Naval Aircraft Factory in Philadelphia built more as the F-5-L with Liberty 12A engines and other modifications. The first flew on 15 July 1918, only four months after the plans were delivered. The N.A.F built 137 F-5-Ls, Curtiss 60 and Canadian Aeroplanes Ltd, 30. They were operational before the end of the war and remained in U.S. Navy service until 1928. One F-5-L fuselage has been preserved by the Smithsonian Institution. ■

Felixstowe F.2A

Crew: Four or five
Length: 46ft 3in (14.1m)
Wingspan: 95ft 8in (29.15m)
Height: 17ft 6in (5.34m)
Empty weight: 7,549lb (3,424kg)
Max T/O weight: 10,978lb (4,980kg)
Powerplant: Two Rolls-Royce Eagle VIII V12 piston engines rated at 345hp (257kW) each
Max speed: 96mph (154km/h)
Service ceiling: 9,600ft (2,926m)
Endurance: 6hr
Armament: Four 0.303in machine-guns; up to 460lb (210kg) of bombs

The main production Dolphin Mk. I used a geared Hispano-Suiza engine; the Mk. III used a direct-drive version of the same motor. *USMC Archives*

Sopwith 5F.1 Dolphin

Hunnish-looking Bus

The Dolphin was one of the better fighters of the late war period but somewhat overlooked by history. Some pilots distrusted its back-staggered wings and exposed seating position.

The exact date of the first flight of Sopwith's new fighter is obscure, but the manufacturer was testing its limits by late May 1917 and 500 were ordered the following month following official trials.

The Dolphin adopted an unusual configuration with the wings staggered backwards with the upper wing behind the cockpit so as to give the pilot the best forwards and upwards view. This exposed his head somewhat and there were various attempts to provide rollover protection, although none were adopted. Quick-release fittings on bracing wires around the cockpit helped the pilot escape if the aircraft was upside down. The rear decking was lowered after the pre-production aircraft were tested and the bulky radiators were on the fuselage sides were replaced by smaller units. The Dolphin's unconventional looks caused one observer to call the Dolphin "a decidedly Hunnish-looking bus."

Production aircraft had reduced back stagger and steel tube undercarriage struts. A pair of Lewis guns were mounted on a pivoting mount above the wing. This was heavy and cumbersome and one gun was soon removed, with the other usually following. One squadron mounted a pair of Lewis guns on the lower wings, firing outboard of the propeller arc, giving heavy fixed firepower for the day.

Dolphins were flown operationally by four squadrons. No. 19 Squadron replaced their Spads with Dolphins in January 1918. Nos. 79, 23 and 87 Squadrons reached the front by the end of April. Some others were used by No. 141 Squadron for home defence, but proved unsuitable for rapid interceptions as their liquid-cooled engines took a long time to warm up before take-off. In generally there were supply difficulties with the geared Hispano engine and it proved unreliable when it was available, mainly due to disintegrating reduction gears.

A total of 1,778 Dolphins were built by Sopwith Hooper & Co. Ltd and the Darracq Motor Engineering Company up to August 1919. The type was declared obsolete in September 1921, although a small number served beyond that with Poland.

American Frederick Gillett of No. 79 Squadron was the top Dolphin ace, claiming 20 victories, including three balloons and 14 Fokker D.VIIs

The Dolphin II was developed with a 300hp (224kW) direct drive Hispano-Suiza engine to be built in France for the U.S. Air Service, but contracts for 2,000 were cancelled with the Armistice. The Dolphin III was to have the more reliable 200hp (149kW) 'Hisso' engine, but again, only a handful were built. ■

Sopwith Dolphin

Crew: One
Length: 22ft 3in (6.78m)
Wingspan: 32ft 6in (9.90m)
Height: 8ft 6in (2.59m)
Empty weight: 1,466lb (
Max T/O weight: 2,008lb (908kg)
Powerplant: One Hispano-Suiza piston engine rated at 200hp (149kW)
Max speed: 128mph (206km/h)
Service ceiling: 21,000ft (6,400m)
Endurance: 2hr 15min
Armament: Two 0.303in Vickers and up to two 0.303in Lewis machine-guns; up to 100lb (45kg) bombs

A D.H.9 of the New Zealand Permanent Air Force alongside D.H.4s at Wigram. NZPAF aircraft retained their RAF serials. *Air Force Museum of New Zealand*

Airco D.H.9 and D.H.9A

Nine and Nine-Ack

The D.H.4 was developed into the D.H.9 with mixed success. A further change of engine created the D.H.9A, which served the new RAF into the 1930s.

Following heavy German bombing raids on England in May 1917, the British defence establishment and Cabinet agreed that both Home Defence and offensive bombing squadrons of the RFC be substantially strengthened. Seven hundred D.H.4s were ordered, but it was argued that a longer-range version could be produced with only seven weeks' delay to deliveries. The Air Board agreed to substitute this new D.H.9 for the D.H.4s on order. By July, the prototype (a modified D.H.4, A7559) was flying. It featured a re-shaped nose with the radiator relocated to a retractable position between the undercarriage legs and the pilot's cockpit repositioned further aft so that it was no longer located between the engine and fuel tanks. The engine was the 300hp (220kW) B.H.P. (also known as the Galloway Adriatic), which was an unfortunate choice. Despite many problems, including faulty castings which caused the engine to be derated to 230hp (176kW), mass production had already begun as the Siddeley Puma and it was too late to prevent the first batches of D.H.9s being delivered with this underperforming motor.

D.H.9s were built by a wide range of contractors: Airco, Vulcan; G & J Weir; Berwick; Cubitt; Mann, Egerton; Short Brothers; Waring & Gillow; Westland; Whitehead; Alliance and National Aircraft Factories Nos. 1 and 2. The type would eventually serve with 18 squadrons in France and Belgium; five coastal patrol squadrons in the UK; two bomber squadrons in Macedonia; four in the Mediterranean; five in the Aegean; and later two in Russia.

When the D.H.9 reached the Western Front in April 1918 it was inferior to the DH.4 it replaced. Unable to fly high with a full bomb load, 54 D.H.9s were lost to enemy action and 94 otherwise written off between May and November. Nos. 99 and 104 Squadrons reported engine failures on approximately one in every seven sorties. On one mission to Mainz in July, three of 12 No. 99 Squadron aircraft turned back with engine failure, seven were shot down by German fighters and only two returned to their home airfield.

The D.H.9 could defend itself, however. Lt John Stubbs of No. 103 Squadron was the top-scoring ace, scoring 11 victories with three different observers.

The U.S. Marine Corps' 1st Marine Aviation Force was equipped with D.H.4s and 9As when it flew its first independent mission on 14 October 1918. The crew of 2nd Lt Ralph Talbot

D.H.9s of No. 120 Squadron during the winter of 1918-1919. The unit was based at Wyton and Hawkinge in this period. *Air Force Museum of New Zealand*

and Cpl Robert Robinson each shot down a German fighter. Robinson was wounded, but Talbot landed near a Belgian hospital where the gunner was successfully treated. Both aviators were awarded the Medal of Honor.

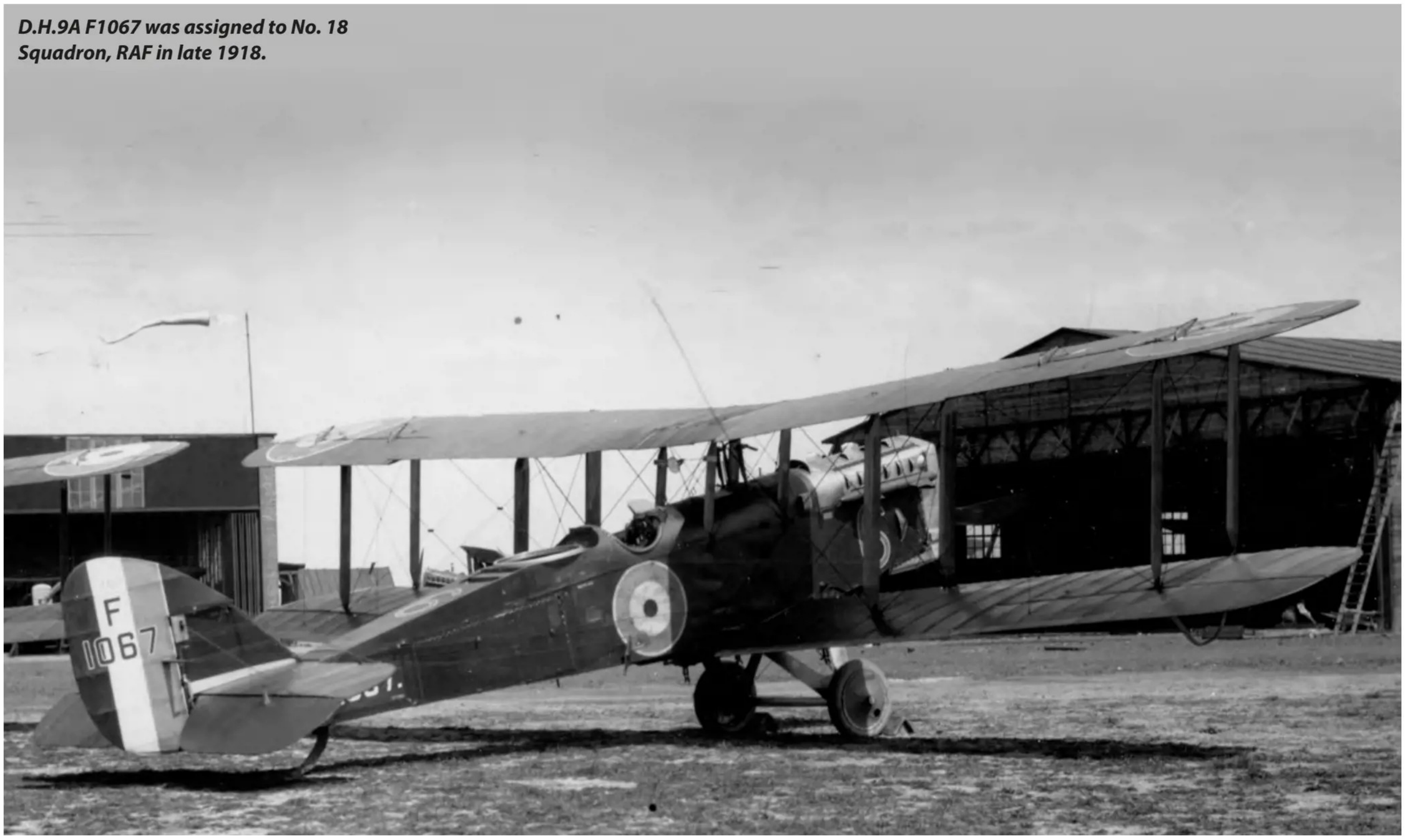
In the Middle East they were more successful against Turkish forces without air cover. D.H.9s based on Aegean islands made long-range bombing missions against Constantinople. A few D.H.9s were supplied to the US, and others went to Belgium, Canada, New Zealand and South Africa, the latter modified as the Mpala with Jupiter engines. Tests with different engines produced varying results, the Napier Lion proving the best, but the 'Lion-Nine' did not enter production. At war's end the D.H.9s were assigned duties such as mail-carrying and air ambulance, but were out of RAF service by July 1919.

Despite this obsolescence Belgium received 74 in 1919-1922 and SABCA built a further 29. Some remained in service up to 1930 in bombing, observation and training roles.

American interest in producing the DH.9 with

Westland-built D.H.9A H3452 was part of a batch ordered in July 1918. *Leonardo*

D.H.9A F1067 was assigned to No. 18 Squadron, RAF in late 1918.



D.H.9A E8765 took part in the British contribution to the Russian Civil War. In the foreground is a 112lb bomb.

Air Force Museum of New Zealand

Rebuilt D.H.9As served the RAF into the 1930s in various colonial outposts, often carrying the mail, but dropping bombs when required. This aircraft was with No. 27 Squadron in India's North West Frontier. *Air Force Museum of New Zealand*

the 400hp (298kW) Liberty engine led to the D.H.9a (more commonly styled D.H.9A). Because Airco was busy with the D.H.10, design work was carried out by Westland at Yeovil, Somerset.

The DH.9A had larger wings and returned to the frontal radiator design, giving a very different appearance in profile. The pilot had a synchronised Vickers gun and the observer one or two Lewis guns. Although suffering some teething troubles on its mid-1918 combat debut, the 'Nine-Ack' soon proved its reliability and suffered proportionally fewer losses than the DH.9 in its brief combat career.

Great Britain sent forces to support the Russian government during the Civil War. One contingent was dispatched to protect the northern ports of Murmansk and Archangel and included D.H.9s and 9As. Some were also provided to White Russian forces. They were used on bombing and strafing attacks against the Bolsheviks before withdrawal in September 1919.

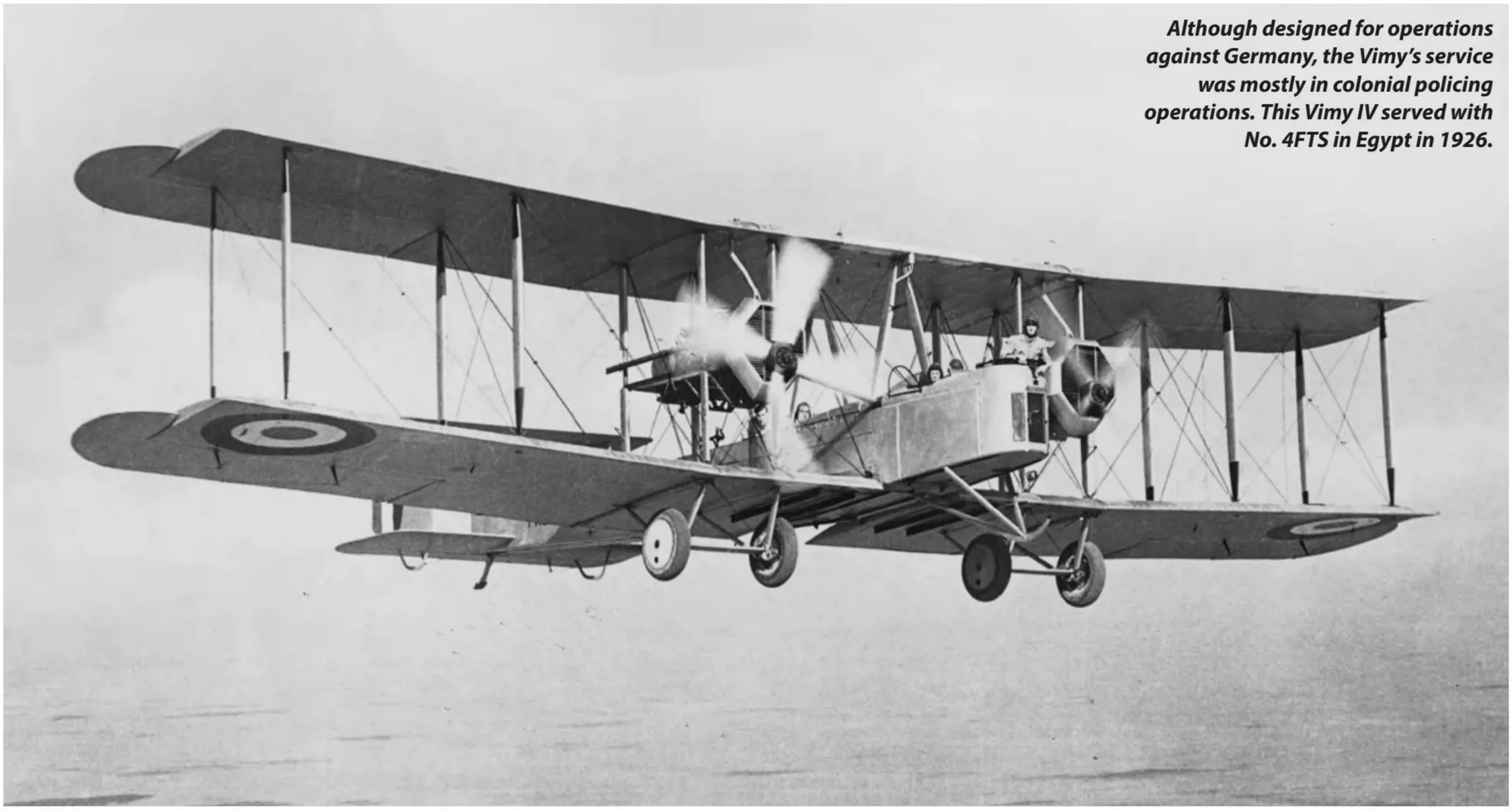
In the 1920s numerous D.H.9As were refurbished and the type mainly served in the colonial policing role in the Near and Middle East. In many situations the appearance of an aircraft was enough to quell local unrest, but not always. In June-September 1920, D.H.9s and 9A squadrons in Iraq flew over 4,000 hours, dropped nearly 100 tons of bombs and fired more than 183,000 rounds of ammunition. They lost 11 aircraft in hostile territory with nine airmen killed in action.

From 1929, the D.H.9As gave way to the Westland Wapiti, the last RAF 'Nine-Ack' finally retiring in 1932.

DH.9s and DH.9As were supplied to a number of countries as 'Imperial Gift' aircraft, helping establish the air arms of Australia, New Zealand and Canada. As well as military duties, they were involved in numerous route proving, survey and airmail flights and experiments into the early 1930s. DH.9As, often modified with new fuselages, became the pioneering equipment of many airlines. ■

Airco D.H.9A

Crew: Two
Length: 30ft 0in (9.14m)
Wingspan: 46ft 0in (14.02m)
Height: 10ft 9in (3.28m)
Empty weight: 2,800lb (1,270kg)
Max T/O weight: 4,900lb (2,223kg)
Powerplant: One Liberty 12A V-12 piston engine rated at 400hp (298kW)
Max speed: 114mph (183km/h)
Service ceiling: 16,500ft (5,029m)
Endurance: 5hr 45min
Armament: One 0.303in Vickers and one or two 0.303 Lewis machine-guns; bomb load up to 450lb (204kg)



Although designed for operations against Germany, the Vimy's service was mostly in colonial policing operations. This Vimy IV served with No. 4FTS in Egypt in 1926.

Vickers Vimy

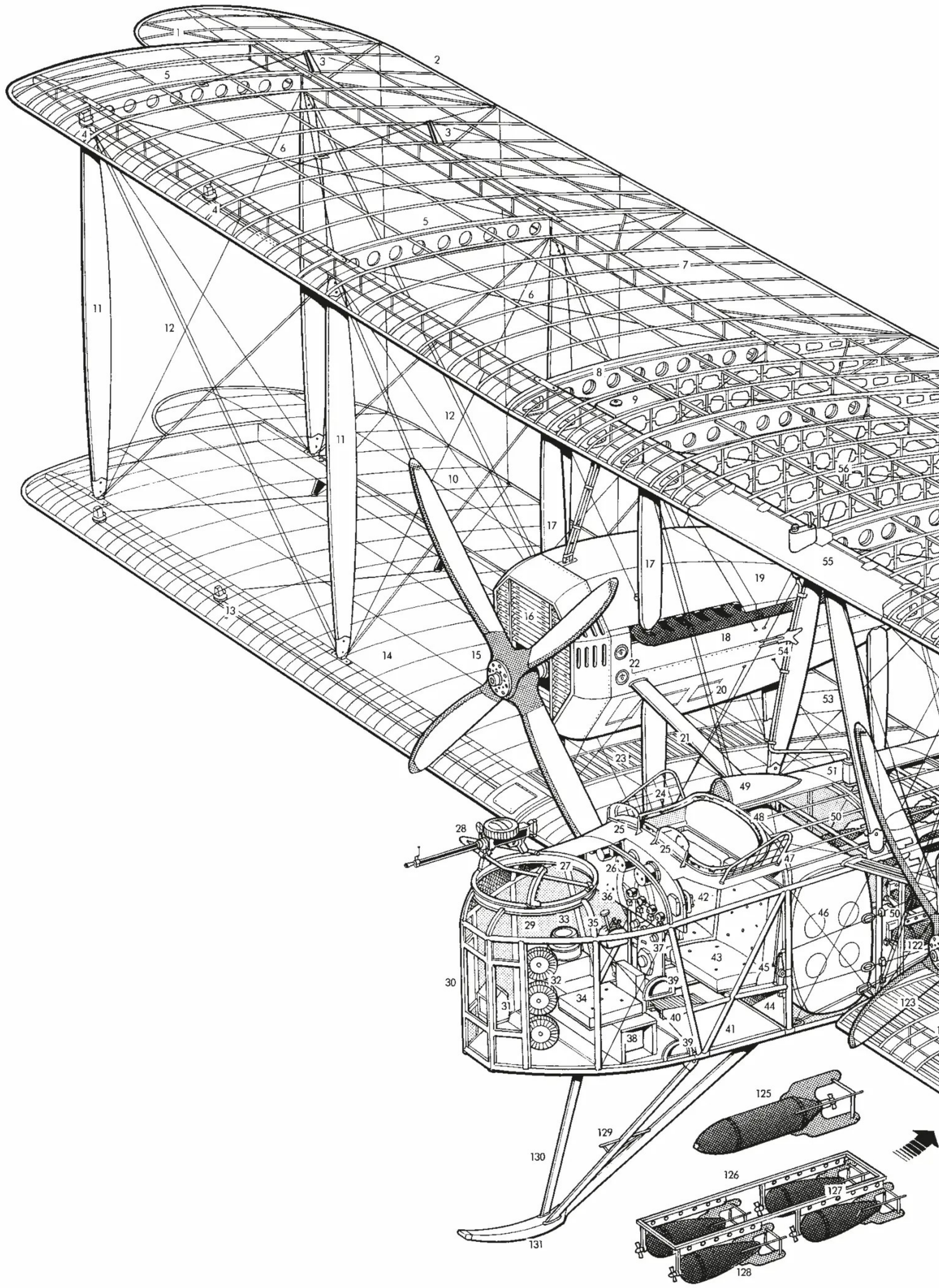
Long-Range Pioneer

German raids on England spurred the development of strategic bombers for retaliatory attacks. The Vimy was probably the most famous of these, but more so for its peacetime pioneering flights.

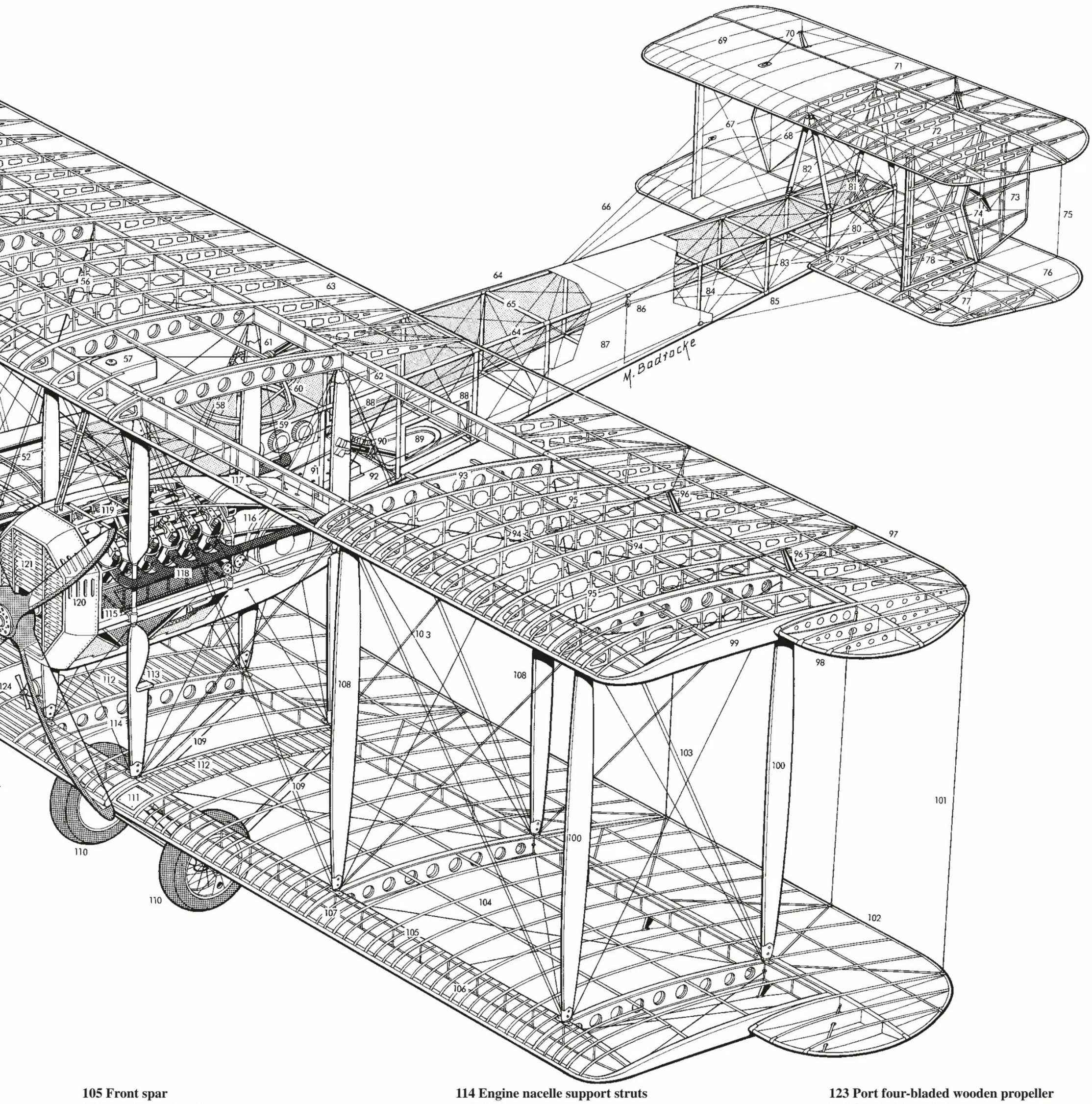
On 30 November 1917, only four months after the Air Board issued an urgent specification for a new heavy night bomber, the prototype F.B.27 or Vimy made its first flight at Joyce Green in the hands of Capt. Gordon Bell. Scaling up the configuration of the E.F.B.7 and 8 twin-engined fighters of late 1915, Vickers' Rex Pierson designed a large equal-span two-bay biplane with engines mounted between the wings. The square-section fuselage had an open gun

At one time operated by No. 9 Squadron, Vimy IV F8631 was lost when it crashed into a tree in March 1924. *Jim Winchester collection*

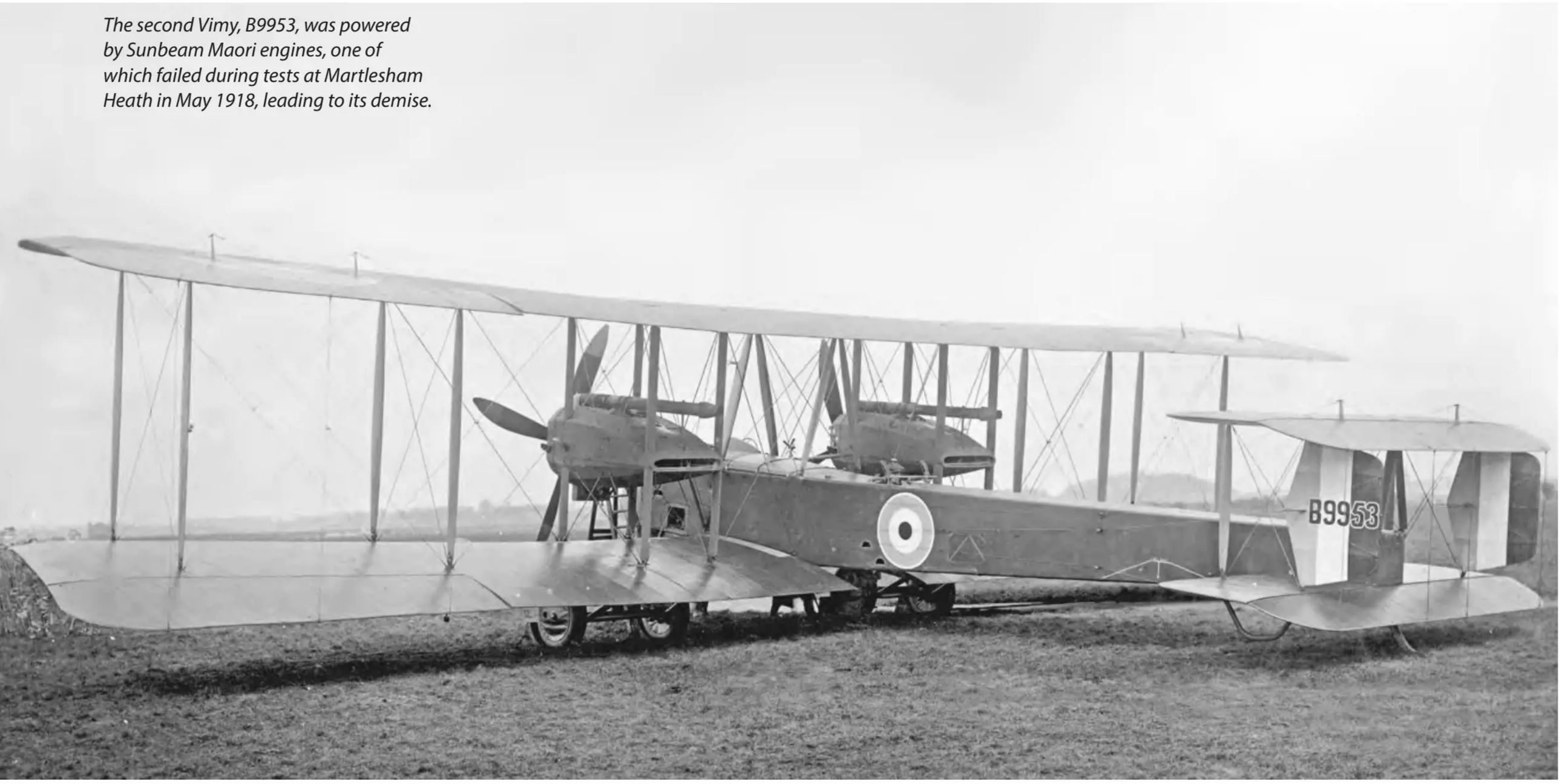
Vickers Vimy



1 Aileron horn balance
2 Starboard
3 Aileron control horn
4 Aileron balance cables
5 Compression ribs
6 Wing panel internal wire bracing
7 Fixed portion of trailing edge
8 Outer wing panel joint rib
9 Radiator header tank
10 Starboard lower aileron
11 Starboard interplant struts
12 Diagonal wire bracing
13 Aileron control cable runs
14 Wing-panel fabric covering
15 Starboard four-bladed propeller
16 Radiator shutters
17 Engine nacelle support struts
18 Exhaust pipe
19 Starboard engine nacelle
20 Nacelle access panels
21 Fuel feed pipe and control cable duct
22 Engine instruments
23 Wing walkway
24 Cockpit propeller guard
25 Windscreen panel
26 Instrument panel
27 Scarff ring gun-mounting
28 0.303in Lewis gun
29 Front gunner/bomb aimer's compartment
30 Nose compartment glazing
31 Drift sight
32 Spare ammunition containers
33 Compass
34 Gunner/bomb aimer's seat
35 Engine throttle and mixture control levers
36 Control column handwheel
37 Fuel system control panel
38 Flare stowage
39 Boarding steps
40 Pilot's footboards
41 Cockpit floor panel
42 Pilot's seat
43 Front gunner/bomb aimer/observer's seat
44 Cockpit rear bulkhead
45 Elevator cable control lever
46 Forward main fuel tank, 861 gal
47 Port propeller guard
48 Cockpit coaming
49 Pilot's head fairing
50 Internal bomb-bay (provision for 12x112b or 230lb HE bombs)
51 Fuel system header tank
52 Aft main fuel tank, 140 gal
53 Centre-section inverted V-struts
54 Pitot tubes
55 Leading-edge gravity-feed fuel tank, 15 gal
56 Wing centre-section rib construction
57 Port radiator header tank
58 Rear gunner's compartment
59 Spare ammunition containers
60 Scarff ring gun mounting
61 0.303in Lewis gun
62 Wing rear spar
63 Trailing-edge ribs
64 Fuselage top longerons
65 Horizontal spacers
66 Tail control cables
67 Starboard fixed fin
68 Starboard rudder
69 Fabric-covered tailplane
70 Elevator control horn
71 Upper elevator
72 Tailplane rib construction
73 Port rudder construction
74 Rudder control horn
75 Elevator interconnecting cables
76 Lower elevator
77 Tailplane tip skid
78 Port fin construction
79 Tailplane spar attachment
80 Tailskid
81 Elastic cord shock absorber
82 Telescopic centre-section inverted-V struts (tailplane trim adjustment)
83 Fuselage diagonal wing bracing
84 Vertical spacers
85 Lower longeron
86 External control-cable runs
87 Fuselage fabric covering
88 Side window panels
89 Ventral gun cut-out
90 0.303in Lewis gun
91 Ventral gunner's position
92 Rear fuselage fuel panels
93 Outer wing panel double compression ribs
94 Rib bracing stringers
95 Outer wing panel rib construction
96 Aileron control horns
97 Port upper aileron
98 Aileron horn balance
99 Wingtip rib
100 Outer interplane struts
101 Aileron interconnecting cables
102 Port lower aileron
103 Diagonal wire bracing
104 Port lower wing panel



105 Front spar
106 Leading-edge rib construction
107 Inter-rib stiffeners
108 Inner interplane struts
109 Main undercarriage support struts
110 Twin mainwheels
111 Inspection panel
112 Engine maintenance walkways
113 Step
114 Engine nacelle support struts
115 Engine bearer
116 Oil tank
117 Oil filler cap
118 Exhaust pipe
119 Rolls-Royce Eagle V-12 engine
120 Cooling air louvres
121 Port radiator shutters
122 Propeller hub attachment plate
123 Port four-bladed wooden propeller
124 Wind-driven fuel pump
125 230lb HE bomb, carried beneath fuselage longerons
126 Underwing bomb racks
127 Bomb release units
128 112lb HE bombs, four per wing
129 Boarding step
130 Skid support struts
131 Front skid



The second Vimy, B9953, was powered by Sunbeam Maori engines, one of which failed during tests at Martlesham Heath in May 1918, leading to its demise.

position at the front and a box-like biplane tail at the rear. Much of the internal construction was steel tube.

A contract for three prototypes was issued in July 1917, based on little more than an outline sketch. The first aircraft was powered by two 200hp (149.2kW) Hispano-Suiza geared inline engines with a two-bladed propeller and later by 260hp (194kW) Salmson radials. The second, called the Vimy I, had 260hp Sunbeam Maoris and the third, the Vimy II, had 300hp (223.8kW) Fiat A-12s, but crashed during testing. The fourth prototype had Rolls-Royce Eagle VIIIs. The many engine variations stemmed from a shortage of H-S engines, which were urgently needed for the S.E.5 programme. The first production order specified either 230hp B.H.P, 400hp Fiat or 400hp Liberty 12 engines, seemingly whatever was available.

Contracts were issued for 150 Vimys in March 1918 and by the Armistice, nearly 1,000 were on order. Production of the Fiat-engined Vimy II and the Vimy IV with the 360hp Rolls-Royce Eagle VIII began in 1918. With such small engines, the performance was hardly exhilarating, although good for its time. The maximum speed was only 103 mph (166 km/h) – with a bomb load it was more like 81mph (130km/h). The Vimy took 22 minutes to reach 5,000ft (1525m).

The first available aircraft were rushed to the Western Front, but only a handful (sources vary between one and seven) had arrived by the time of the Armistice on 11 November 1918 and they saw no action. All production contracts were then cancelled, but reinstated later to equip the post-war bombing force. Vickers built 145; Westland, 25; Morgan & Co, 40 and at least 16 by the Royal Aircraft Establishment. The design had been perfected in the RAE's Farnborough wind tunnel.

Delays with engine production kept the Vimy out of full squadron service until 1920, initially overseas. They were mainly used in the Middle East, particularly in Egypt, with four active units and a training school. Two bomber squadrons and one flight were equipped with Vimys in the UK from 1922. When the supply of Eagle engines ran out, many aircraft were re-engined with Bristol Jupiter and Armstrong Siddeley Jaguar radials.

A version for civilian use was built as the Vimy Commercial. This had a larger diameter fuselage and served as the basis of the Vimy Ambulance, which could take four stretchers or eight sitting passengers. The Vernon of 1921 was a bomber/transport version along similar lines with a bulbous fuselage and domed nose. This was the first purpose-built troop transport aircraft and 55 were built. The RAF operated some on the Cairo–Baghdad airmail service until 1927.

The Vimy's claim to fame is its use in several long distance record-breaking flights. Using a modified Vimy IV, James Alcock and Arthur Whitten Brown flew from Newfoundland to Ireland on 14/15 June 1919 in a flight taking 16hrs 47min. Brothers Ross and Keith Smith and two crew made the first England–Australia flight in October/November 1919, taking nearly a month. A Vimy also attempted the first England–South Africa flight in February 1920. The first aircraft crashed near Cairo and a replacement made it only as far as Southern Rhodesia. The crew completed the flight in a D.H.9.

The Vimy was mainly retired from front-line service in 1924–5, although one squadron in Northern Ireland retained the aircraft until 1929. The last Vimys were used as parachute trainers (with the trainees clutching the interplane struts from take-off to jump) until 1931. ■

Vickers Vimy Mk. IV

Crew: Three
Length: 43ft 7in (13.27m)
Wingspan: 67ft 2in (20.47m)
Height: 15ft 3in (4.65m)
Empty weight: 7,101lb (3,221kg)
Max T/O weight: 12,500lb (5,670kg)
Powerplant: Two Rolls-Royce Eagle VIII V-12 piston engines rated at 360hp (269kW)
Max speed: 103 mph (166 km/h)
Service ceiling: 7,000ft (2,134m)
Range: 910 miles (1,464 km)
Armament: two 0.303in Lewis machine-guns; bomb load up to 2,476lb (1124kg)

Snipe replica VH-SNP was built in Australia in 2013 and is fitted with a Continental W-670 radial engine. *David Willis*

Sopwith Snipe

The RAF's Last Rotary-Engined Fighter

The Snipe was a good fighter, but arrived too late to supplant the Camel or win over its experienced pilots before the war ended.

By the time the Camel reached the front, Herbert Smith at Sopwith had already designed its successor. The 7F.1 was much the same configuration as the camel, but had a cut-down rear fuselage and other changes to improve visibility from the cockpit. It was powered by the 230hp (172kW) Bentley BR.2 rotary engine.

In February 1918 the Snipe was evaluated against the Austin Triplane, the Boulton & Paul Bobolink and the Nieuport B.N.1, which were all designed to the Air Board's Type I-Single-seat fighter (high altitude) specification. None of these were particularly impressive and the Snipe was ultimately selected because it was thought the "least undesirable" overall. It also made much use of existing Sopwith components, which would ease production and maintenance.

The third prototype and subsequent aircraft had a two-bay wing, and the Snipe's span was 2ft (61cm) greater than the Camel's. This made it more stable, but experienced pilots who had got used to the twitchiness of the Camel didn't like it. The Snipe wasn't much faster than the Camel but had a better rate of climb, taking 15min less to reach its maximum altitude.

Snipes reached front line squadrons at the end of August 1918 with No. 43 Squadron. No. 201 and No. 4 Squadron Australian Flying Corps followed in October. A long-range development, the 7F.1a was intended as an escort fighter for the bombers of the Independent Force and had an extra 50gal (227 litre) fuel tank under the pilot's seat. Some had been delivered by the war's end. A number of squadrons on the Continent were equipped with Snipes in November-December 1918, but flew them for only a few months.

There were three Snipe aces: Elwyn King (seven victories on Snipes); Thomas Baker (six) and Arthur Palliser (five). All three were Australians with No. 4 Squadron AFC who had also scored on the Camel. On 27 October 1918, while on secondment with No. 201 Squadron, Canadian pilot William Barker shot down a Rumpler two-seater, then tangled with a large formation Fokker D.VIIIs, bringing down three of them despite being wounded three times. He crash-landed behind friendly lines and was later awarded the Victoria Cross for this action.

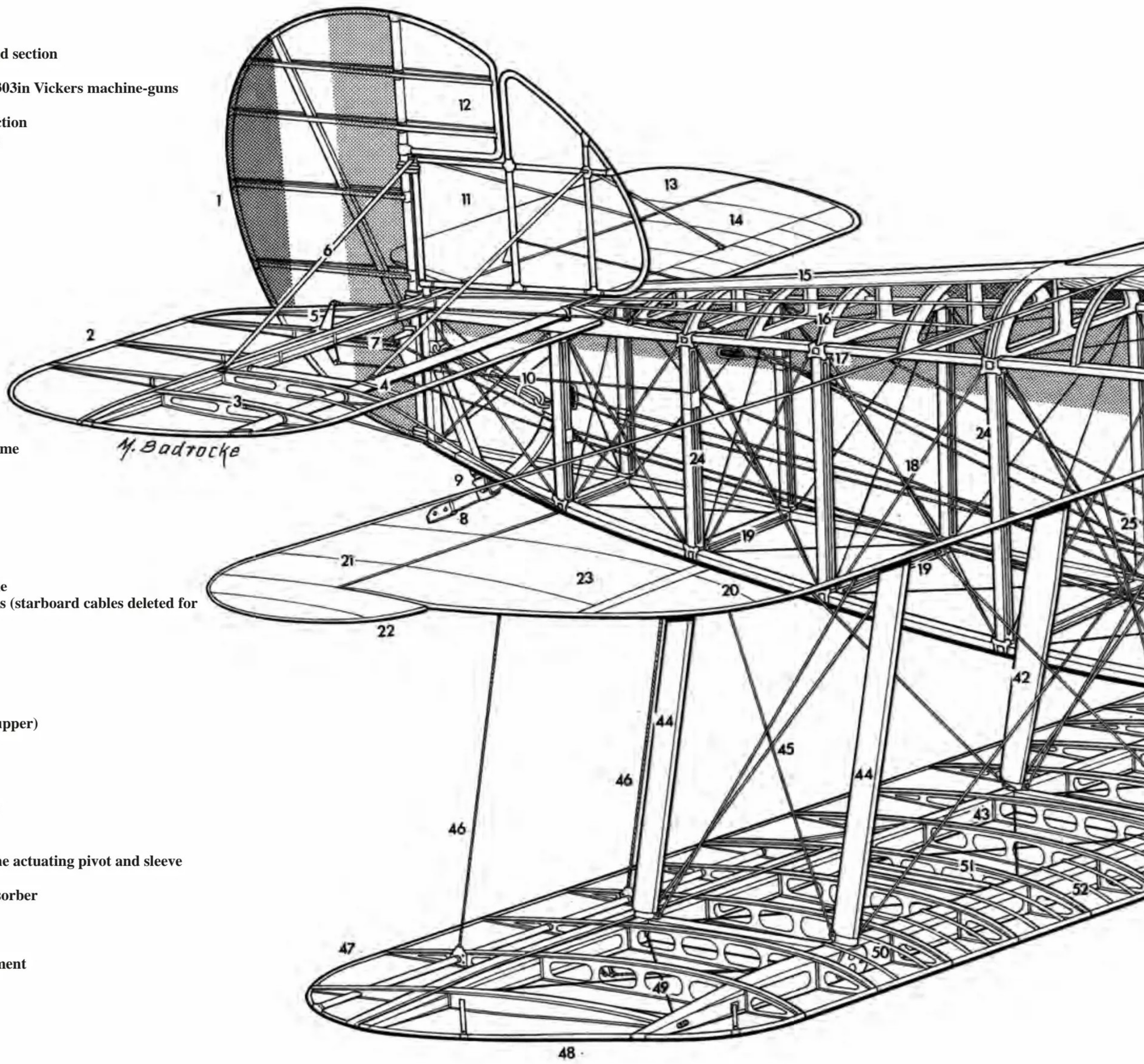
In 1920 more squadrons in Egypt, India and the UK reformed with Snipes and scrapping of stored examples was stopped. The Snipe remained in service as the RAF's main night fighter into the 1920s, finally retiring in 1926. A dozen were sent to Russia as part of the RAF's involvement in the Civil War and two or three were captured, serving in the Soviet Air Force. ■

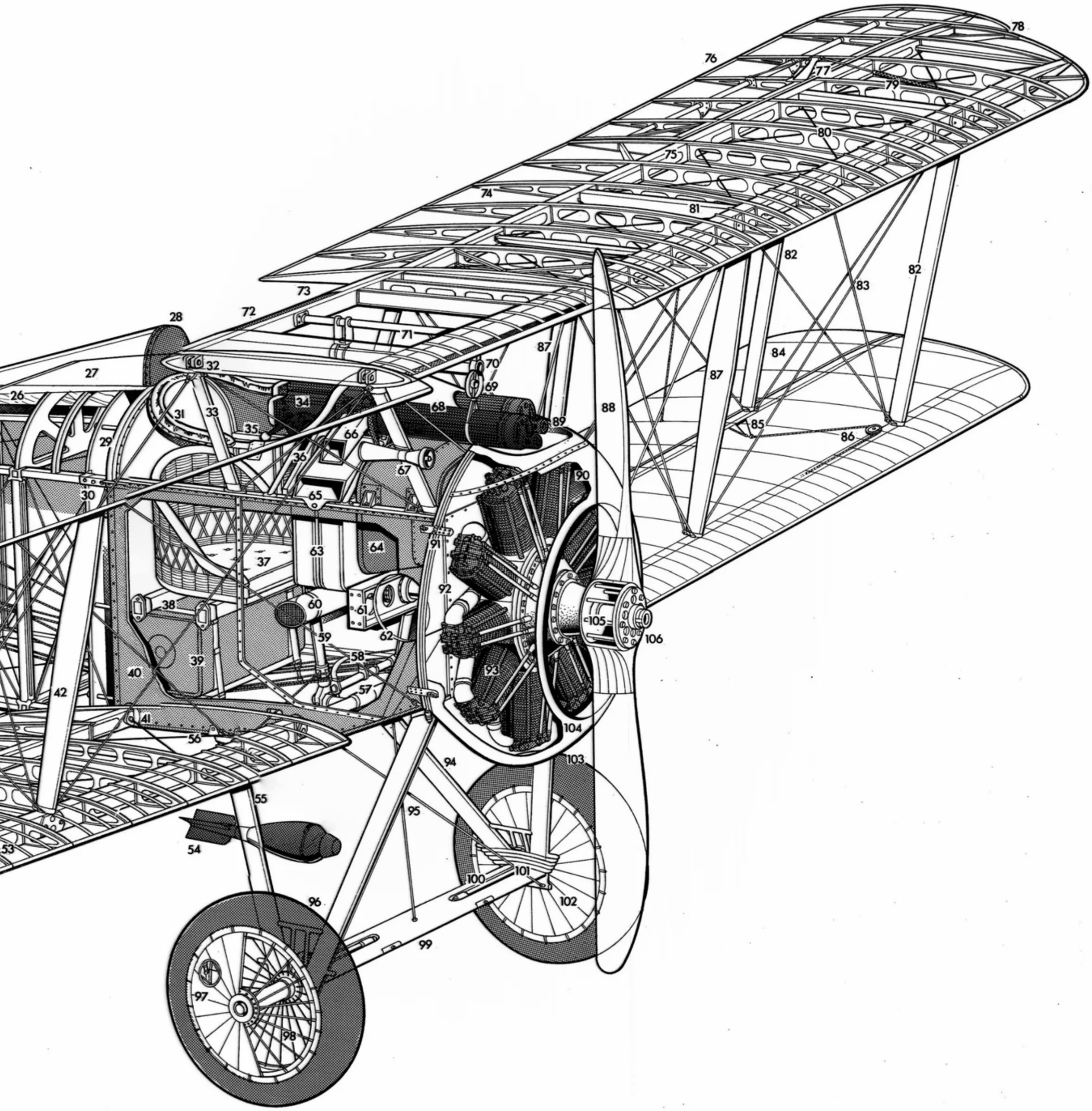
Sopwith 7F.1 Snipe

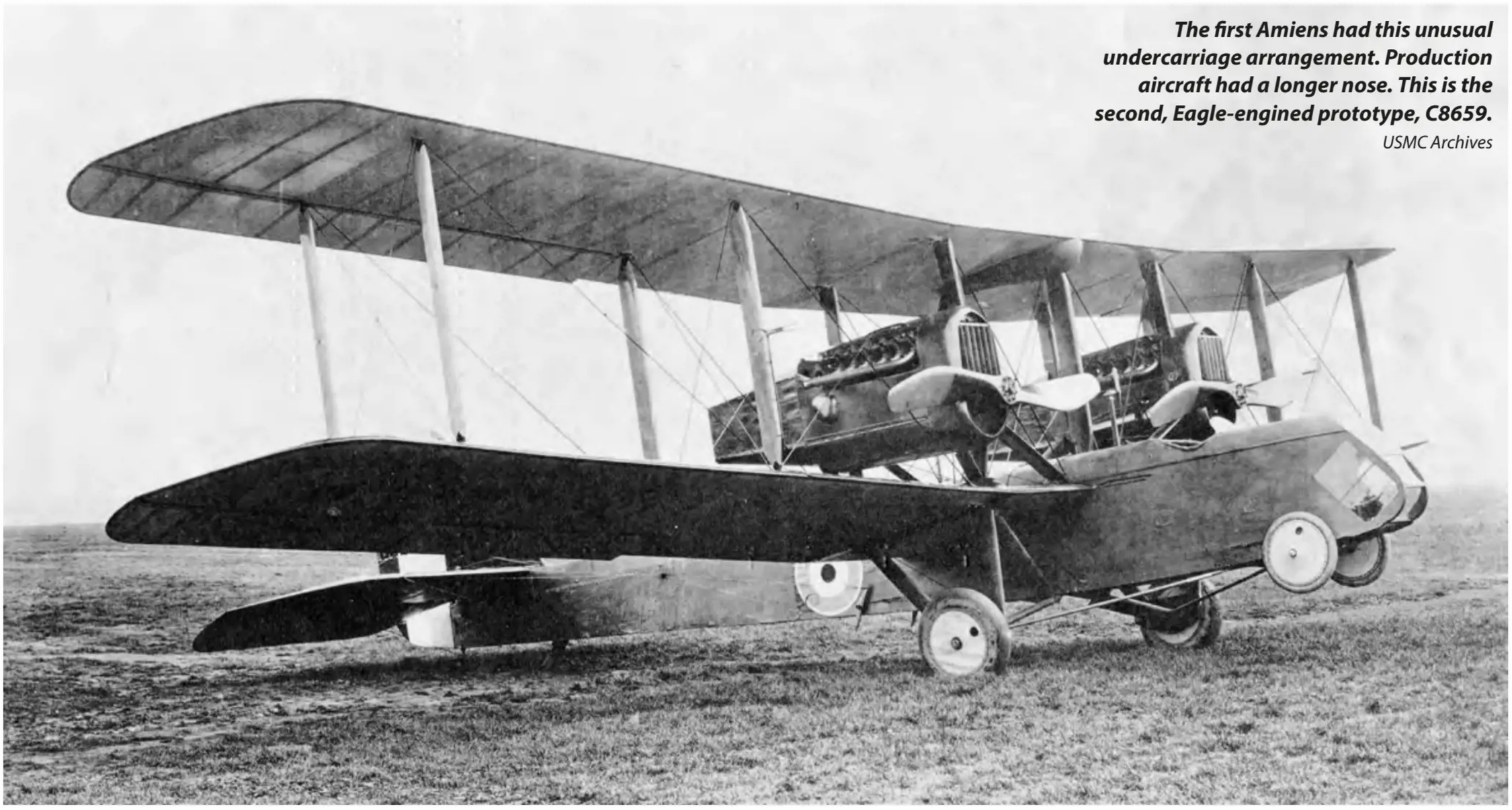
Crew: One
Length: 19ft 2in (5.8m)
Wingspan: 30ft 0in (9.1m)
Height: 9ft 6in (2.9m)
Empty weight: 1,305lb (592kg)
Max T/O weight: 2,015lb (914kg)
Powerplant: One Bentley B.R.2 piston engine rated at 230hp (172kW)
Max speed: 121mph (195km/h)
Service ceiling: 19,500ft (5,944m)
Endurance: 3hr
Armament: Two 0.303in Vickers machine-guns; four 20lb bombs

Sopwith 7F.1 Snipe

1 Lang two-blade wooden propeller
2 Propeller attachment plate
3 Attachment bolts
4 Engine cowling
5 120hp Bentley B.R.2 engine
6 Engine bulkhead/bearer
7 Combined gravity/oil tank
8 Tank/longeron attachment
9 Forward fuselage member
10 Cartridge ejector chute
11 Fuselage cross-member
12 Rudder pedal bar
13 Fuselage frame
14 Ammunition magazine
15 Gun mounting bars
16 Instrument panel (left-hand section
17 Link ejector chute
18 Two fixed synchronised 0.303in Vickers machine-guns
19 One-piece screen
20 Horizontal wing centre-section
21 Centre-section front struts
22 Gun muzzles
23 Interplane struts
24 Diagonal bracing
25 Leading-edge stiffeners
26 Front spar
27 Spar connecting frame
28 Wing ribs
29 Diagonal cross-bracing
30 Aileron horn balance
31 Aileron hinge
32 Starboard
33 Aileron cable (interplane)
34 Rear spar
35 Centre-section cut-out
36 Padded cockpit coaming
37 Centre-section rear strut
38 Pilot's wicker-work seat
39 Wooden seat mounting frame
40 Fuel tank
41 Entry steps
42 Dorsal frame
43 Dorsal centre-board
44 Upper longeron
45 Fuselage stringers
46 Vertical frames (spacers)
47 Fuselage side fairing profile
48 Port elevator control cables (starboard cables deleted for clarity)
49 Dorsal decking
50 Diagonal cross-bracing
51 Rudder control cables
52 Starboard tailplane
53 Tailfin structure
54 Starboard tailplane stay (upper)
55 Rudder horn balance
56 Rudder structure
57 Rudder post
58 Elevator control hinges
59 Port tailplane stay (upper)
60 Port elevator
61 Rudder hinge fairing
62 Variable-incidence tailplane actuating pivot and sleeve
63 Tailskid
64 Tailskid damper/skock absorber
65 Lower longeron
66 Flat undersides
67 Interplane strut (inner)
68 Rear spar/fuselage attachment
69 Interplane cross-bracing
70 Wing ribs
71 Rear spar
72 Interplane struts (outer)
73 Aileron control cable
74 Port lower aileron
75 Aileron control hinge
76 Diagonal bracing
77 Leading-edge stiffeners
78 Front spar
79 Front spar/fuselage attachment
80 Undercarriage 'X'-brace
81 Undercarriage legs
82 Valve access
83 Axle support
84 Port mainwheel
85 Wheel spokes
86 Axle fairing
87 Elastic cord shock-absorber
88 Starboard mainwheel




78
76
77
79
80
75
74
81
82
82
83
73
72
28
71
87
84
27
32
70
69
87
26
34
68
88
31
33
89
35
66
85
86
29
36
67
90
30
65
91
63
64
37
92
38
60
61
105
106
62
59
39
58
93
40
57
42
41
104
56
94
103
55
95
53
54
101
100
102
96
99
97
98



The first Amiens had this unusual undercarriage arrangement. Production aircraft had a longer nose. This is the second, Eagle-engined prototype, C8659.
USMC Archives

Airco DH.10 Amiens

Wheely Twin

Airco copied the basic configuration of the unsuccessful Beardmore-engined D.H.3 of 1916 to meet an April 1917 specification for a twin-engined bomber. An overambitious engine supply programme resulted in few D,H.10s seeing wartime service.

C4283, the first D.H.10 Amiens prototype, flew on 4 March 1918 but proved somewhat underpowered by the 230hp (172kW) Siddeley Puma engines mounted in pusher configuration. These required cut-outs in the trailing edges to provide propeller clearance, which were unnecessary when 360hp (269kW) Eagle VIII engines were substituted on the third and subsequent aircraft

The three prototypes (Amiens Mk. IIs) had a short nose with a glazed bomb-aimer's position and wheels mounted either side of the nose to allow a level landing attitude. The Liberty-engined fourth D.H.10 had a longer, plywood nose containing a gunner's position, fuel tanks and a bomb bay. This and production aircraft were called Amiens Mk. IIIs, although the name was barely used during the type's short service.

Trials showed the D.H.10 was faster than the D.H.9A and could carry twice the bomb load.

Relocating the engines to directly on the lower wing rather than supported on struts created the Mk. IIIA

A pair of D.H.10s were used for trials of the 1 1/2-pounder Coventry Ordnance Works quick-firing gun, known as the COW Gun. The nose was lengthened and nose wheels were brought back. Firing tests appear to have been successful, but one aircraft crashed just after take-off due to engine failure, – something that was not uncommon with the Amiens – probably due to the fuel pumps struggling at lower airspeeds. Post-war, one aircraft was modified with twin fins and rudders in an attempt to improve the asymmetric flying characteristics.

Despite contracts for 800 with Airco, Siddeley-Deasy, National Aircraft Factory No. 2 and Daimler issued by April 1917 and for 475 more from Airco, Alliance and Mann, Egerton in July, delays in Liberty engine production meant that only about 260 D.H.10As and some Eagle-engined D.H.10Cs were ever delivered.

Just one frontline squadron, No. 104, had received D.H.10s by the end of October 1918 and then only two of the eight delivered to the RAF. The plan for 1919 was for eight squadrons of the Independent Force to be equipped with the type, but this never came to pass after the Armistice. One day before that event, the Amiens made its only recorded wartime raid when one aircraft (F1867) bombed Sarrebourg aerodrome, apparently because its crew wanted to see action before the war ended.

The Amiens saw post-war service in the Middle East and India, including bombing recalcitrant tribesmen on the North-West Frontier. The type also saw some service as a mailplane. The last was withdrawn in 1926. ■

Airco DH.10 Amiens Mk. IIIA

Crew: Three
Length: 39ft 7in (12.01m)
Wingspan: 65ft 6in (19,96m)
Height: 14ft 6in (4.42m)
Empty weight: 5,750lb (2,608kg)
Max T/O weight: 9,060lb (4,119lb)
Powerplant: Two Liberty 12 piston engines rated at 400hp (298kW)
Max speed: 131mph (211km/h)
Service ceiling: 19,000ft (5,791m)
Endurance: 6hr
Armament: 2-4 0.303in Lewis machine-guns; bomb load up to 920lb (417kg)

The prototype T.F.2 Salamander E5429 seen at Brooklands. *Archives Canada*

Sopwith T.F.2 Salamander

Trench Fighter

The Salamander was a dedicated 'strafer' developed in the spring of 1918. The rapid advances of the last months of the war meant that it saw little active service.

Camels were being used for ground-attack but suffered high losses to enemy fire. One aircraft, B9278, was modified as the T.F.1 (for 'Trench Fighter') with armour plate around the pilot's seat and two Lewis guns mounted at a downwards angle through the cockpit floor.

British Expeditionary Force Specification No. 2 of 1917 called for an aircraft with improved performance over the Snipe optimised for ground-attack missions. Sopwith responded with a design based on the Snipe with the same 230hp (172kW) Bentley and the armour of the Camel TF.2. The forward fuselage, fuel tanks and cockpit were protected by an armoured box, weighing no less than 650lb (295kg). Oddly, the lower part of the engine was exposed by a large cut-out; this was to provide additional cooling at low level, where the aircraft would mainly be operating.

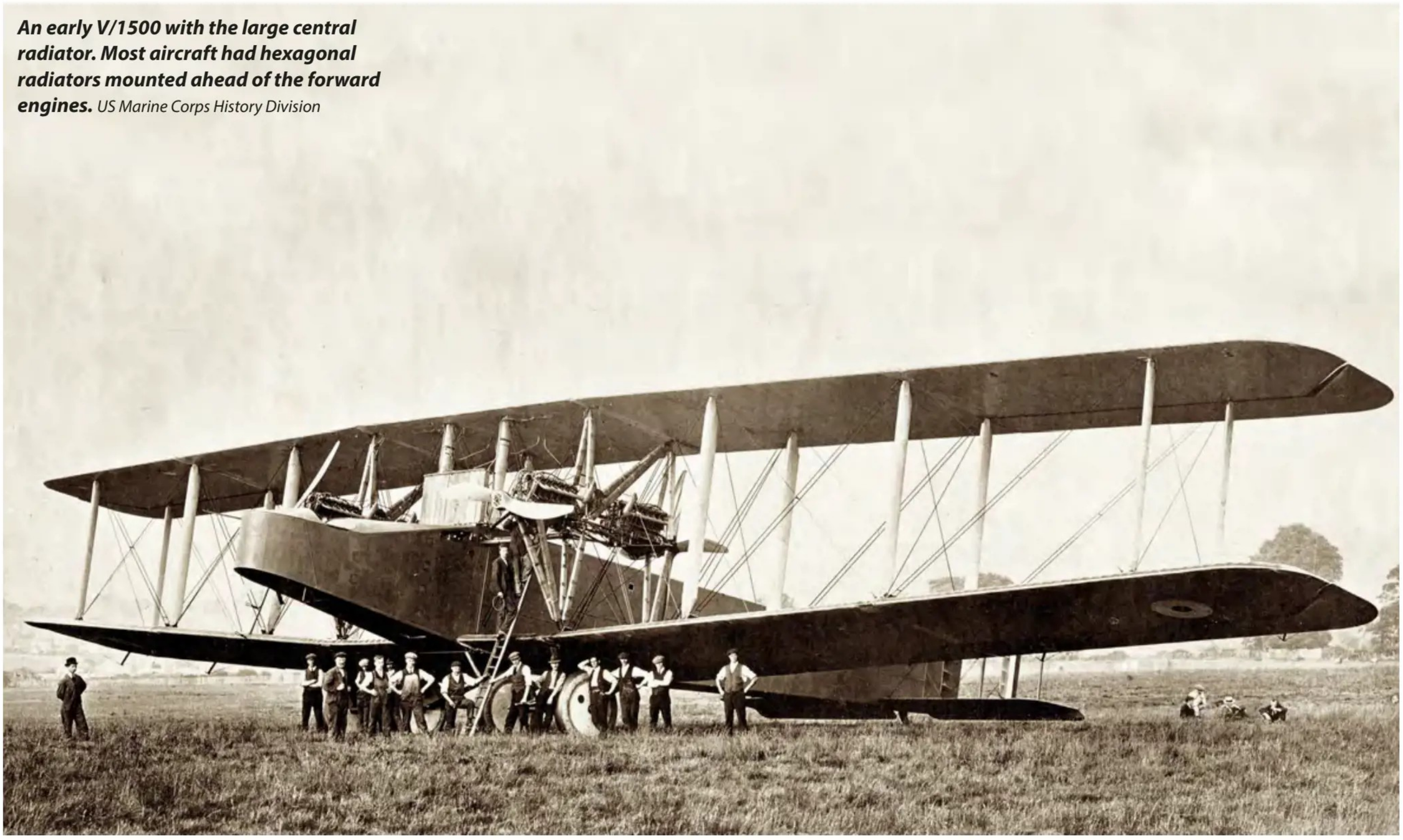
A prototype T.F.2 Salamander flew on 27 April 1918. Within three weeks it had been sent to the front for operational trials and three more prototypes had flown. Tests were positive and an order for 500 aircraft soon followed, to be built by Sopwith at Kingston and Glendower Aircraft At nearby Kew. As many more would have been built by other contractors including Palladium Autocars in Putney and the National Aircraft Factory at Waddon, Surrey, but the Armistice intervened. In the end, 210 were built: 160 by Sopwith and 50 by Glendower. Production aircraft had larger ailerons and tailfins and a standard armament of two forward-firing Vickers guns, although with ammunition increased from 1,500 to 2,000 rounds.

At least one prototype was fitted with duplicated aileron connecting cables to provide extra resistance to damage from ground fire. Another aircraft was armed experimentally with eight machine-guns firing through the cockpit floor

At the end of October 1918, 37 Salamanders had been accepted by the RAF, but only two of these were in France, with No. 86 Squadron at Phalempin. A few others were with No. 5 Squadron at Wyton and No. 157 Squadron at Upper Heyford, both of which were training to be ground-attack units. ■

Sopwith TF.2

Crew: One
Length: 19ft 6in (5.94m)
Wingspan: 31ft 3in (9.53m)
Height: 9ft 4in (2.84m)
Empty weight: 1,844lb (836kg)
Max T/O weight: 2,512lb (961kg)
Powerplant: One Bentley B.R.2 piston engine rated at 230hp (172kW)
Max speed: 125mph (201km)
Service ceiling: 13,000ft (3,962m)
Endurance: 1hr 30min
Armament: Two 0.303in Vickers machine-guns



An early V/1500 with the large central radiator. Most aircraft had hexagonal radiators mounted ahead of the forward engines. *US Marine Corps History Division*

Handley Page V/1500

British Giant

The first true strategic bomber, the Handley Page V/1500 was Britain's answer to the German 'Giants' and was built with the intention of raiding Berlin direct from English bases.

Designed by George Volkert, the H.P.15 or V/1500 was intended to be powered by two 600hp (448kW) Rolls-Royce Condor engines, but delays in their development necessitated the use of four Eagle VIIIs in back-to-back layout. The engine configuration was modelled on that of the German R-planes. The tractor engines drove an enormous two-bladed propeller while the pusher engines each had a four-bladed unit. The prototype had a single radiator for all four engines, but the production aircraft had a hexagonal radiator for each pair. To handle the great weight of the V/1500 the undercarriage was built from steel tube with independent shock absorbers on the four wheels.

Of the same general layout as the O/100 and O/400, the V/1500 was of similar length but had over one-third greater span. The centre-section was perpendicular, but the long outer sections were gently swept back. Rearward-folding wings allowed the V/1500 to be stowed in the standard Bessonneau canvas hangars of the day. Defensive armament comprised single or twin 0.303-in Lewis guns in the nose, dorsal, ventral and tail positions. The warload was stowed internally and consisted of up to 30 250lb bombs.

The prototype flew in May 1918 but crashed the following month on its 13th fight. Production contracts were issued with Harland and Wolff of Belfast for 200 aircraft, but the majority were cancelled at the Armistice and only 20 were completed. Three V/1500s were issued to No. 166 Squadron at Bircham Newton in Norfolk and were prepared for their first raid on Berlin in November 1918. Bad weather frustrated the mission and the Armistice was called before it could be carried out.

One aircraft (J1936, named 'Old Carthusian') made the first England–India flight in December 1918 via Rome, Malta, Cairo, and Baghdad to Karachi (then in India), taking 17 days. During unrest in Afghanistan in May 1919, this aircraft was called to make a bombing attack on Kabul. The four bombs that fell on the Amir's palace caused him to sue for peace. This was the only known combat mission for the V/1500.

In 1919 one V/1500 was shipped to Newfoundland with the intention of making the first Atlantic air crossing. Before it was ready, James Alcock and Arthur Whitten Brown achieved the crossing in a Vickers Vimy and the V/1500 attempt was abandoned. In general the V/1500 saw little post-war service before being replaced by the Vimy. ■

Handley Page V/1500

Crew: Up to seven
Length: 64ft 0in (19.51m)
Wingspan: 126ft 0in (38.40m)
Height: 23ft 0in (7.01m)
Empty weight: 17,600lb (7,983kg)
Max T/O weight: 30,000lb (13,608kg)
Powerplant: Four Rolls-Royce Eagle VIII V12 piston engines rated at 375hp (280kW)
Max speed: 99mph (159km/h)
Service ceiling: 11,000ft (3,355m)
Range: 1,300 miles (2,092kg)
Armament: Four to eight 0.303in Lewis machine-guns; bomb load up to 30 250lb bombs

The prototype Martinsyde F.3, B1490. The F.3 was developed into the Buzzard with a revised cockpit and rear fuselage profile.
Archives Canada.

Martinsyde Buzzard

Fast, But Too Late

The Buzzard fighter was probably the fastest production aircraft of World War I, but it never saw full squadron service with the RAF.

Martinsyde tested its R.G. single-seat fighter in February 1917, but the S.E.5a and Camel were chosen for production. Combining features of this and the one-off F.2 two-seater produced the F.3 in the autumn of 1917. With the new Rolls-Royce Falcon, its performance was impressive and production was ordered. Only six F.3s were completed, four of which were sent to Home Defence units.

To explore an alternative to the Falcon III, which was more urgently required for the Bristol Fighter, an F.3 was fitted with a 300hp (220kW) Hispano-Suiza engine. The cockpit was relocated slightly further back, improving downward visibility. Construction was based around a deep wooden box girder fuselage skinned with plywood and fabric. Armament was the standard pair of Vickers guns, but these were faired Into the forward fuselage, firing through troughs.

Tested in June 1918, the F.4 Buzzard proved superior to the production Sopwith Snipe in speed, climb rate and service ceiling. The Royal Air Force immediately ordered 1,450 aircraft, although due to difficulties in engine supply, only seven Martinsydes were handed over to the RAF before the end of the war. No. 39 Squadron at North Weald received two and one went to No. 141 Squadron at Biggin Hill, but they never saw combat. The Snipe had been chosen as the RAF's standard fighter and there was no room for the Buzzard after 1918, although more than 300 were produced and mostly put into storage. The 57 or so that saw RAF service would be used as high-speed communications aircraft and at the Central Flying School.

The USA ordered 1,500 F.3s to be powered by Liberty 8 engines, but quickly cancelled. Later American interest in the F.4 with a Wright-built 300hp Hispano-Suiza ended with the Armistice.

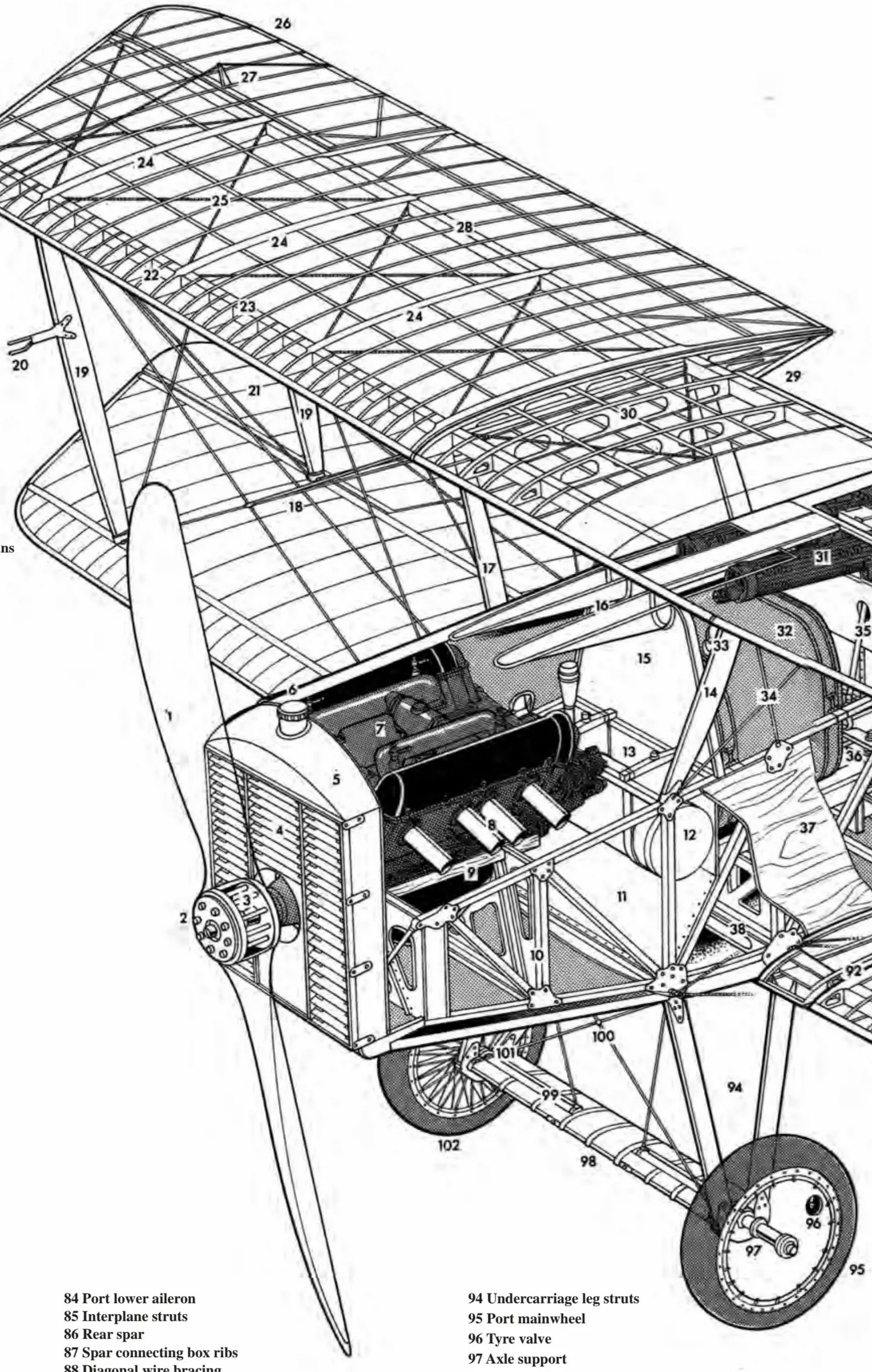
Martinsyde went into receivership in 1921 and its assets and rights were eventually acquired by the Aircraft Disposal Company, which offered some derivatives including the Jaguar-engined ADC1, of which eight were sold to Latvia. ADC also supplied others, mostly standard models, to Spain, Ireland, Portugal, Latvia and the Soviet Union. Single examples of the type found their way to Poland, Japan and Uruguay.

Spanish examples remained in use until the outbreak of the Civil War, while Finland's last example was retired in 1940. The last surviving Buzzard (and Martinsyde aircraft) is in the Finnish Air Force Museum. ■

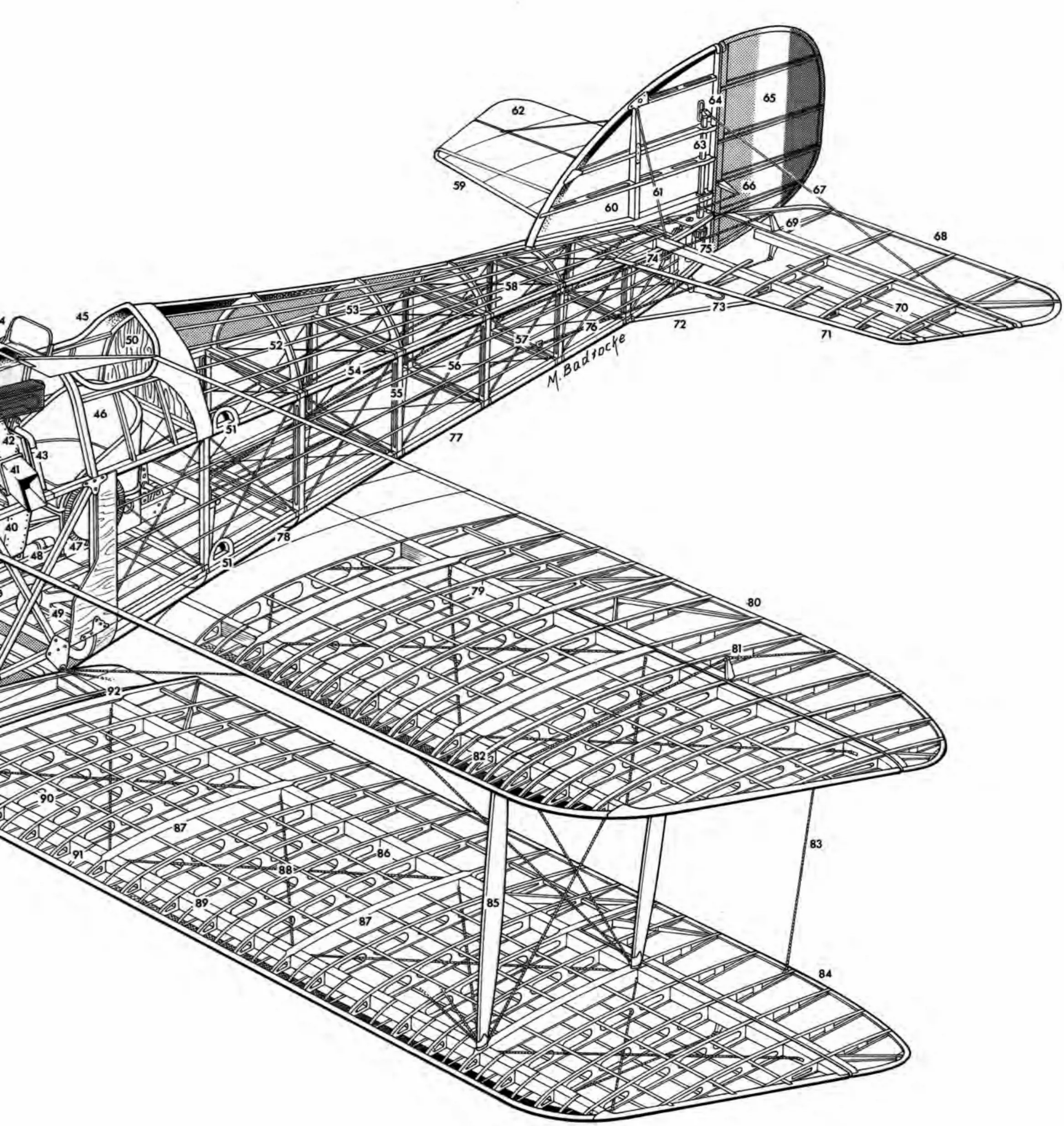
Martinsyde F.4

Crew: Two
Length: 25ft 6in (7.7m)
Wingspan: 32ft 9in (10.0m)
Height: 8ft 10in (2.69m)
Empty weight: 1,811lb (821kg)
Max T/O weight: 2,398lb (1,088kg)
Powerplant: One Hispano-Suiza 8Fb inline piston engine rated at 300hp (220kW)
Max speed: 146mph (235km/h)
Service ceiling: 24,000ft (7,300m)
Endurance: 2.5hr
Armament: Two 0.303in Vickers machine-guns

Martinsyde F.4 Buzzard



1 Two-blade wooden propeller
2 Propeller attachment plate
3 Attachment bolts
4 Radiator shutters
5 Radiator
6 Filler cap
7 305hp Hispano-Suiza
8 Exhaust stubs
9 Engine bearer
10 Front fuselage construction
11 Engine bulkhead
12 Oil tank
13 Oil tank bearers
14 Cnetre-section front struts
15 Fuel tank bulkhead
16 Gun muzzle blast troughs
17 Starboard centre-section struts
18 Diagonal wire bracing
19 Interplane struts
20 Pitot head
21 Starboard lower aileron
22 Leading-edge stiffeners
23 Front spar
24 Spar connecting box ribs
25 Diagonal cross-bracing
26 Starboard upper aileron
27 Aileron control hinge
28 Rear spar
29 Centre-section cut-out
30 Centre-section construction
31 Two fixed synchronised 0.303in Vickers machine-guns
32 Fuel tank
33 Fuel tank filler
34 Centre strut diagonal bracing
35 Gun bracing attachment
36 Rudder pedal bar
37 Front fuselage plywood skin covering
38 Fuselage cross members
39 Pilot's floorboards
40 Ammunition tank
41 Link ejector chute
42 Instrument panel
43 Gun fixing frame
44 Windshield
45 Cockpit coaming
46 Pilot's seat
47 Tailplane trim control wheel
48 Aileron control tube
49 Seat mounting frames
50 Cockpit bulkhead
51 Entry steps
52 Dorsal frames
53 Dorsal stringer construction
54 Upper longeron
55 Vertical spacers
56 Diagonal bracing
57 Fuselage stringers
58 Tail control cables
59 Starboard tailplane
60 Fin construction
61 Fin bracing wire
62 Starboard elevator
63 Tailplane trim jack
64 Rudder post
65 Rudder construction
66 Rudder control hinge
67 Tailplane trim jack
68 Port elevator
69 Elevator control hinge
70 Tailplane construction
71 Port tailplane
72 Tailplane stay (lower)
73 Tailskid
75 Variable-incidence tailplane control
76 Elevator control cable
77 Fuselage lower longeron
78 Under fuselage fairing
79 Port upper wing construction
80 Port upper aileron
81 Aileron control hinge
82 Leading-edge construction
83 Aileron connecting cable
84 Port lower aileron
85 Interplane struts
86 Rear spar
87 Spar connecting box ribs
88 Diagonal wire bracing
89 Front spar
90 Wing ribs
91 Leading-edge stiffening
92 Lower wing spar attachment pins
93 Stub wing
94 Undercarriage leg struts
95 Port mainwheel
96 Tyre valve
97 Axle support
98 Axle fairing
99 Pivoted half axle
100 Undercarriage cross-bracing
101 Elastic cord shock absorber
102 Starboard mainwheel


M. Badrocke
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
40
41
42
43
45
46
47
48
49
50
51
52
53
54
55
56
57
58

Preserved British WW1 Aircraft

Great War Survivors

Nearly 110 years after the end of the conflict, a fair number of World War One-era British aircraft remain. Most of the original examples are in the great aeronautical collections, but an increasing number of restored, replica and reproduction aircraft are in private hands, many of them airworthy.

At Lambeth, London and Duxford, Cambridgeshire, the Imperial War Museum (IWM) collection, includes several genuine wartime survivors including an RNAS Sopwith Camel that shot down a Zeppelin, a D.H.9, an R.E.8. and Bristol F.2b. The Royal Air Force Museum at Hendon, London and Cosford in Shropshire contains the best collection of genuine World War One types, among them a Sopwith Dolphin and and an S.E.5a, mixed with some replicas, including a 1½ Strutter and Sopwith Triplane.

The Shuttleworth Collection at Old Warden, Bedfordshire flies genuine examples of the Avro 504K, Bristol F.2B, S.E.5a and Sopwith Pup as well as reproductions of the Bristol M.1 and Scout C, and the Sopwith Camel and Triplane.

The largest collections of Great War Aircraft are in New Zealand, mostly thanks to filmmaker and enthusiast Sir Peter Jackson. His company, The Vintage Aviator Ltd (TVAL) at Masterton has restored and recreated many types, from the B.E.2 to the R.E.8 and D.H.5. The Omaka Aviation Heritage Museum near Blenheim houses many of these when they are not flying. ■

1 ***The National Air & Space Museum in Washington D.C. exhibits 1918-built Sopwith 7F.1 Snipe E8082, which came from the Old Rhinebeck Aerodrome Museum collection in the 1980s.*** *NASM*

2 ***Sopwith 2.F1 Ship's Camel N8156 is displayed at The Canadian Air and Space Museum at Rockcliffe, Ottawa. It was Hooper and Company Limited of London, England in late 1918. The collection also contains a Snipe and a Farman Shorthorn.*** *Jim Winchester*

3 ***There are no original Airco D.H.2s in existence, but the Omaka Aviation Heritage Museum houses an accurate and airworthy TVAL-built reproduction marked as '7855' of No. 29 Squadron in 1916-17.*** *Jim Winchester.*

4 ***The Imperial War Museum's D.H.9, D5649, was rediscovered in India in the 1990s and restored to static condition by Retrotec in East Sussex alongside E8894, which flew in May 2019.***
Jim Winchester

Lufthansa 1926-2026

NEXT ISSUE!

This year, Germany's national airline celebrates 100 years since its founding. When it was formed as Deutsche Luft Hansa from the amalgamation of several small carriers in 1926 it inherited a fleet of 126 aircraft of 19 different types. In the interwar years Lufthansa operated land planes, flying boats and even airships and established new air connections between Europe, South America and the Far East.

The company was almost an air force in disguise in the Nazi era, providing a market for German aircraft and training for future Luftwaffe pilots. During World War Two, civil flying stopped and the company became a repair organisation for the military.

Declared part of the Luftwaffe, the company was liquidated in 1951, but reborn in 1953. Since then, Lufthansa has grown to become one of the world's most respected international airlines, flying today to more than 180 destinations in 71 countries, operating 284 aircraft of seven families.

Aviation Archive 85 will cover the turbulent history of Lufthansa through archive photographs, detailed cutaway drawings and accurate profile paintings.

Time flies with AVIATION ARCHIVE

Rediscovering the history of aviation…

Over 100 years in the making, *Aviation Archive* utilises one of the world's greatest aircraft photographic libraries, providing its readership with many 'never seen before' images, including period cutaway diagrams. Combined with incisive writing and a clear and uncluttered design, each issue takes its readers on a chronological journey through the annals of aviation history. This niche approach makes the *Aviation Archive* series highly collectable.

SUBSCRIBE TODAY

TO YOUR FAVOURITE MAGAZINE!

'WILD CARGO': JERRY YAGEN'S B-25 MITCHELL PROFILED
FlyPast
The Heart Of Aviation Heritage
THE TIMELESS ICON
The Supermarine Spitfire – the most famous aeroplane of all?
90TH ANNIVERSARY
A RIGHT ROYAL FOUL-UP!
The royal visit that didn't quite go to plan…
COLD WAR
FLYPAST CLASSICS
Supermarine Spitfire
Sleek, agile, and innovative – its past and its present
A FAMILY CONNECTION
Argosy 'Treble Four' – from confrontation to VIP transport
FAR EAST AIR FORCE
BALLIOL BOY
Lindsay Neale – a forgotten test pilot?
News, opinion, reviews and much more
MARCH 2026
SCAN ME

FlyPast is internationally regarded as the magazine for aviation history and heritage.

THE LAST HIGHLAND CHARGE 250 YEARS ON
BRITAIN'S BEST-SELLING MILITARY MONTHLY
BRITAIN AT WAR
ISSUE 226
DROPPING THE BIGGEST BOMB OF THE BLITZ
But what was the target?
THE RIVER PLATE: CHURCHILL'S FAKE NEWS?
"A lie gets halfway around the world before the truth has a chance to put its pants on"
GOOD MORNING MALAYA!
Britain's anti-communist Dakota broadcasts
COMMANDO COUNTRY
WELDED TO VICTORY
The UK-designed, US-made ships that won WWII
SCAN ME

Britain at War - dedicated to exploring every aspect of the involvement of Britain and her Commonwealth in conflicts from the turn of the 20th century through to the present day.

SIMPLY **SCAN** THE **QR CODE** OF YOUR FAVOURITE MAGAZINE AND **SUBSCRIBE TODAY!**

Order today from our online shop

shop.keypublishing.com

Call +44 (0)1780 480404 *(Mon to Fri 9am - 5.30pm GMT)*

090/26

THE DESTINATION FOR
HISTORIC & MILITARY ENTHUSIASTS

Visit us today and discover all our publications

KEY Publishing

EXTRA PAGES
SOUVENIR ISSUE
March 2026
Issue No 635,
Vol 54, No 03
AEROPLANE
HISTORY IN THE AIR SINCE 1911
SPITFIRE
ANNIVERSARY SPECIAL
FEATURING...
• The real R. J. Mitchell • Shaping the Spitfire • My first Spitfire flight
• Where it excelled... and where it didn't • Making British history
GERMAN JET RESTORATION
Under the skin of Duxford's Heinkel He 162
STORY OF THE 'GINA'
Database 'deep dive' into the Fiat G91

SCAN ME >

Aeroplane is still providing the best aviation coverage around, with focus on iconic military aircraft from the 1930s to the 1960s.

EXCLUSIVE BRITISH AIRWAYS KEEP A TOE IN THE SAND
www.Key.Aero
AVIATION NEWS
The past, present and future of flight
Incorporating AIR INTERNATIONAL
Evolved & EXpanded
THE LATEST DEVELOPMENTS IN THE F-15EX EAGLE II PROGRAMME
POLISH BORDER GUARD
Flying with the Polish Border Guard as it welcomes new aircraft
LOCKHEED VENTURA
Looking back at Lockheed's medium WW2 bomber
TLP
Visiting Europe's Tactical Leadership Programme
PLUS REGISTER REVIEW / AIRBASE & AIRPORT MOVEMENTS / LATEST NEWS AND MORE

SCAN ME >

Aviation News is renowned for providing the best coverage of every branch of aviation.

and subscribe to your favourite magazine...

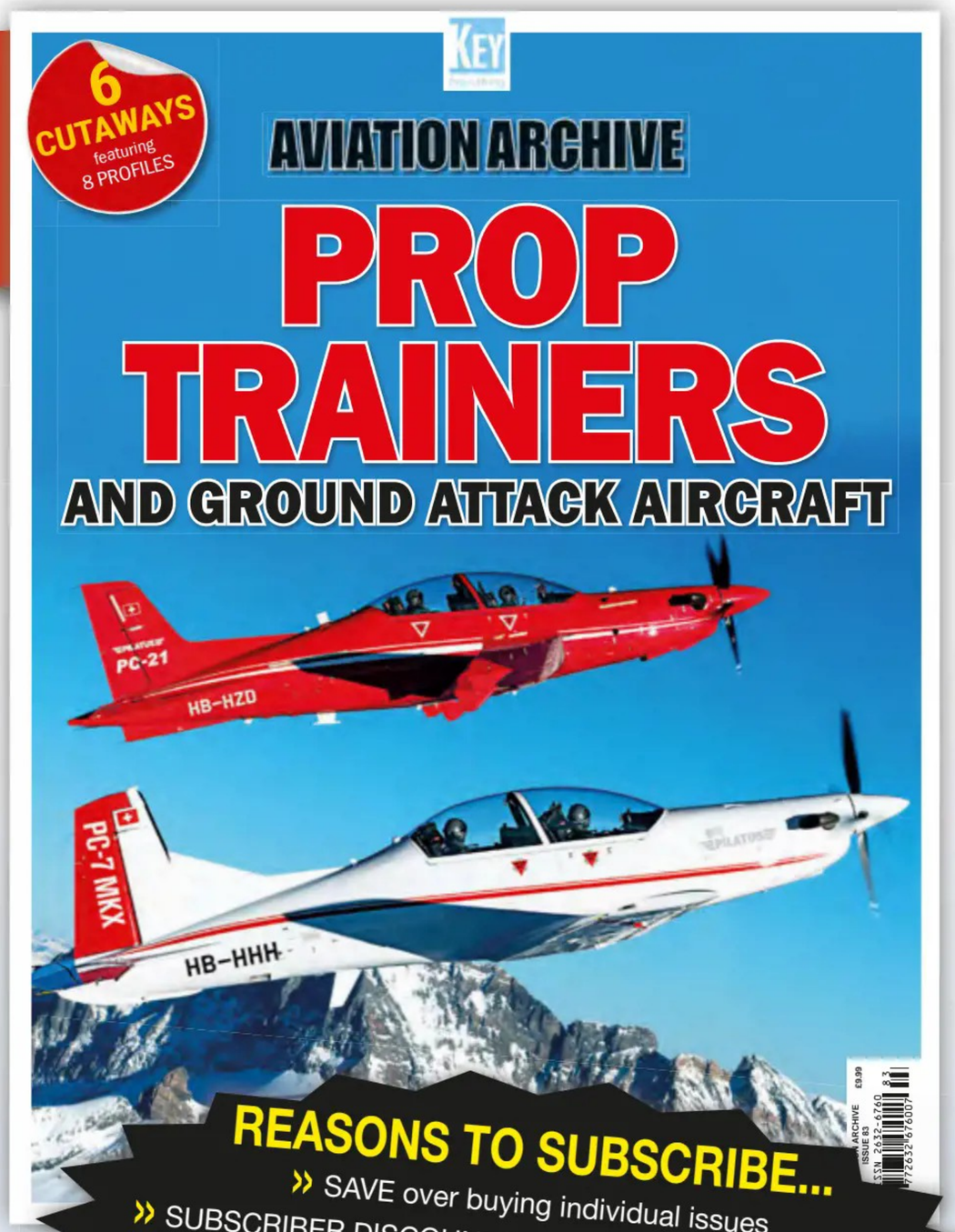
/collections/subscriptions

**Free 2nd class P&P on BFPO orders. Overseas charges apply.*

AVIATION ARCHIVE

CELEBRATING LEGENDARY AIRCRAFT WITH STORIES, HISTORY AND UNFORGETTABLE AVIATION HERITAGE

SUBSCRIBE TODAY!



WHICH OFFER WILL YOU CHOOSE?

OFFER 1 - GOOD!

£54.99 SAVING £4.95!

6 issues (£9.17 an issue!)

Paying by Credit/Debit Card

OFFER 2 - BETTER!

£23.00 SAVING £6.97!

3 issues (£7.67 an issue!)

Paying by 6 month Direct Debit

OFFER 3 - BEST!

£49.99 SAVING £9.95!

6 issues

(ONLY £8.83 an issue!)

Paying by Annual Direct Debit

REASONS TO SUBSCRIBE...

- SAVE over buying individual issues
- SUBSCRIBER DISCOUNTS on *Key Publishing* event tickets
- EXCLUSIVE Subscriber offers on the *Key Publishing* Shop
- DELIVERED DIRECT to your door
- BE THE FIRST to read the latest features

SCAN THE QR CODE TO ORDER DIRECT FROM OUR SHOP

shop.keypublishing.com/aasubs

or call **+44 (0)1780 480404** *(Lines open 9.00am-5.30pm, Monday-Friday GMT)*

Terms and conditions: Quoted rates are for UK subscriptions only, paying one year (6 issues) annual direct debit / debit or credit card or 6-month (3 issues) direct debit. Standard one-year print subscription prices: UK - £54.99, EU - £59.99, USA - £67.99, ROW - £67.99. All quoted prices are subject to change. **CLOSING DATE: 23rd April 2026.**

SCAN HERE TO SUBSCRIBE TODAY!

097/26